technology
review
Published by MIT

The Technology Review

Vol. I. JULY, 1899 No. 3

WILLIAM RIPLEY NICHOLS

M. I. T. '69, Professor of General Chemistry, 1872–1886

William Ripley Nichols was born in Boston, April 30, 1847, and died in Hamburg, Germany, July 14, 1886. He could trace his ancestry to eight of those who came over in the *Mayflower* and to three who came in the *Ann*, Elder Brewster, John Alden, and George Morton among them. Of his grandmother Ripley it is related that having a volume of "The Lady of the Lake" lent to her for a short time, she sat up late reading it aloud, and that after this one reading she was able to repeat pages of it. To this Puritan ancestry he owed his exceeding conscientiousness, his religious tendencies, and that high ideal of moral responsibility which made an uncompromising attitude often seem harsher than was intended. He united with the Eliot Church at the age of fifteen and throughout his busy life he found time to serve in various capacities, even in that exacting position, superintendent of the Sunday school.

He was graduated from the Roxbury Latin School at the age of sixteen and then went abroad with three of his schoolmates in charge of the head master, Mr. Augustus H. Buck. During his two years' absence he not only travelled extensively but studied with avidity, as is shown by his proficiency in French and German and by the fact that on his return in 1865 he entered the Sophomore Class of

Harvard University. Although his early predilections were in the direction of language and literature, he seems to have found the then rigid, non-elastic system too narrow for the best fulfilment of his purpose for himself, and "he deliberately resolved to sever his connection with the first and oldest college in the country and adopt the Institute of Technology, then in the second term of its existence, as the place to prepare himself for the duties and responsibilities of his future life."[1] This step made him at once the object of attention and doubtless aided his rapid advancement, — instructor on graduation, assistant professor the next year, and professor for fourteen years. "It was the first instance in which a young man of promise had made a choice so gratifying to the friends of the new and comparatively unknown school."[1] Although keeping up his interest in modern languages, he became an ardent advocate of the then comparatively new method of teaching chemistry by laboratory work, under the instruction of Charles W. Eliot, now President of Harvard University, at that time the professor of analytical chemistry and metallurgy at the Institute of Technology, and of Frank H. Storer, professor of general and industrial chemistry. In him they found an apt pupil, and what was of more importance to the Institute, in them he found masters from whom he could learn not only details of science but that wisdom which makes for character. His career was profoundly influenced by both. To Eliot he doubtless owed much of the educational creed which made his work so valuable in the formative days of the school; from Storer, whose assistant he became, he took in large measure that high ideal of scientific honor and that regard for accuracy and perfection of detail which characterized his future work.

[1] Professor Runkle. Institute Memorial, p. 16.

Having been implicated as student and assistant in each stage of the development of the Eliot and Storer Laboratory Course of instruction in chemistry, as teacher he was able to bring it to such perfection that it had a national recognition, so that for many years the abridgment of the original was the chief text-book in use in the country, and was even adopted in England. By inheritance and inclination a pioneer, he remained loyal to his chosen Alma Mater even in her darkest days and declined the offer of his old chief — Eliot — of a position at Harvard and, later, of one at the University of Virginia.

His literary taste and facility in modern languages led to his selection in helping to prepare the works of Count Rumford. "He translated anew whatever of Rumford's writings had been published in German or French, and acquitted himself admirably of this by no means easy task. His services finally became so important to the committee, that he was authorized to prepare for the press the copy of the last three volumes of Rumford's works, and to take charge of the revision of the proofs. During a visit to Europe he ransacked the libraries of London, Paris, and Munich in the committee's behalf, and was rewarded by the discovery of some inedited writings of Rumford, which were published by the Academy in due course." [1] All the work of this period, as well as that which followed, was thoroughly well done, and gave full satisfaction to every one connected with it, and to this was doubtless due the turn toward what may be truly called scientific philanthropy.

His association with that pioneer in sanitation, Dr. George Derby, and his readiness to go abroad for study and investigation — not then as common as now — led to his association with the early work of the State Board of

[1] Professor Storer. Proceedings American Academy, 1886, p. 529.

Health. So that when in 1872 it was decided to undertake in Massachusetts a survey for the State similar to that of the Rivers Pollution Commission in England, he was given the commission to carry out the work and for ten years he was, in his own person, engineer, chemist, and sanitary expert. He spent several summers abroad in familiarizing himself with the work of all European countries, while directing the laboratory work of his assistants by correspondence.

Although not a skilful manipulator, he was a critical observer and an appreciative employer. His habit of systematic laying out of work made possible the great amount done, and nothing short of absolute accuracy, as if under oath, was accepted. Each new assistant was put through a vigorous process of testing as to the accuracy of work, no matter at what cost of time and money. This habit of caution, excellent as it was for the sort of work done, combined with a certain reverence for authority inherited from the long line of Puritan ancestry, stood somewhat in the way of the highest fruition of the scientific mind. The work of those years is indicated in the title of the papers found in the list of the publications of the Institute, which he first originated and edited, and in the library which bears his name, and which contained at the time of his death the most complete collection of works on water supply in the country. A characteristic trait is seen in the fact that when he began to receive remuneration for professional work outside of school duties he divided the sum into three parts, one third going to his assistant, one third to himself, and one third to the purchase of standard books for the Institute as a nucleus for the chemical library. This was done without, so far as I know, any suggestion, certainly no compulsion, merely as a matter of right and justice, just as

was his devotion of a fixed part of his income to religious uses. He never used his position for self-aggrandizement at the expense of the Institute.

His great capacity for work, and his talent for organization made him a welcome member of every association, and led him to be severe on those who from mental or physical incapacity could not come up to his standard. All came so easily to him that it seemed impossible for him to sympathize with those who had to grope. It was to him photographic, sudden, and either right or wrong; the suspension of judgment, the middle ground, had no place.

"As a teacher, Professor Nichols was a clear expositor, strong and terse in argument, apt in illustration. To faithful and ambitious students he was, in his calm, steady, lofty way, a constant source of inspiration and encouragement.

"As a disciplinarian, dealing with mixed classes of young men, often ill-trained in their previous studies and exercises, and not always duly attentive and diligent, he was, let it be said in that spirit of truthfulness of which his own character and career afford so shining an example, somewhat severe. Dealing heroically with his own life, health, hopes, pleasures; setting for himself a lofty standard, and holding himself unflinchingly up to its full height, he was, in a degree, deficient in toleration for faults and errors in half-formed or ambiguous characters." [1]

"As a worker, Professor Nichols was distinguished for patience, accuracy, thoroughness, intelligence, and good judgment. Though painstaking to a degree, no trace of pedantry contaminated him. He was never slow or sluggish, and seldom seemed to be in haste. To all appearance, there was plenty of time in each day for the affairs he

[1] General Walker. Institute Memorial, p. 22.

had to attend to, and, indeed, time to spare. Even when most heavily weighted with the burden of his own multifarious occupations, he would cheerfully read proof for his friends, or revise their works; and he was accustomed methodically to answer his share of that innumerable host of letters of inquiry, which in this country pour in like locusts to consume the time and strength of every scientific man who works upon matters of general or public interest. He wrote easily, clearly, and courteously, and his thorough mastery of whatever subject he might present, enforced attention, and disarmed criticism." [1]

His publications of considerable length, relating to sanitary chemistry, number forty-four. The most important among them is his well-known work "Water Supply, Chemical and Sanitary," published in 1883. And in spite of the advances in knowledge it is still a standard work, with a steady sale.

But Professor Nichols did not confine his literary activity to the field of sanitary chemistry. In conjunction with Prof. John Trowbridge and Dr. Samuel Kneeland, he prepared the "Annals of Scientific Discovery" for 1869 and for 1870.

"From the first moment of his connection as a student with the Institute, he had clearly recognized the meaning and significance of the new educational movement to which this school gave expression, and from that time forth he labored for it without haste and without rest." [4]

It is for his work for the Institute in the formative days and the principles for which he stood that every Institute graduate should honor his memory. As a member of the Faculty his influence was, from first to last of his connection with it, altogether and highly useful. "No man did

[1] Professor Storer. Proceedings American Academy, 1886, p. 529–530.

more — doubtless all my colleagues of the Faculty would hasten to say, no man did so much — to create and maintain the peculiar character of this school. He was, beyond all others, master of its rules and methods of procedure. His moral courage and lofty principles of action not only kept him from faltering in difficult situations, in doubtful cases, but were a positive force to hold up the hands and the hearts of his colleagues. Here he was eminently a leader, — and that not by any desire to lead, or a disposition to manage or govern; not from any wilfulness of temper, or through any dialectical or rhetorical artfulness; but solely and always by the clearness of his reasons, and the thoroughness of his convictions, the perfect consistency of his views and purposes." [1]

"In holding this Faculty up to its high standard in the administration of this school, he has done his full share. His broad scholarship, his active and intelligent interest in all departments of instruction, combined with a singularly calm and judicial judgment, have always given his opinions weight in all our most delicate and important deliberations.

"If, in his dealings with the students, he sometimes seemed severe, it was only because he would not allow his sympathy for the individual to swerve him from his duty to the higher interests of the school.

"While he had but little consideration for the idle or the wayward student, beneath a somewhat unimpassioned and austere exterior, there beat a noble and generous heart, sympathetic with the deserving, faithful in its friendships, loving and true in all its family relations, and with a calm and abiding trust in the wisdom, goodness, and mercy of the Infinite Father." [2]

[1] General Walker. Institute Memorial, p. 22.
[2] Professor Runkle. Institute Memorial, p. 18.

"As a teacher, Professor Nichols will long be remembered by those who knew him. He was a clear and terse expositor, and he stood before his scholars as a constant source of inspiration and encouragement, and as a worthy ideal of scientific accuracy and conscientiousness. Indeed, the standard he set for himself was so high, and he held himself so unflinchingly up to it, that he was often judged severe; and it was no doubt difficult for him to appreciate the faults and struggles of characters less lofty than his own.

"It has well been said that if ever one of our race proved the utmost effects of resolution and fortitude in contesting the progress of fatal disease, that man was William Ripley Nichols." [1]

"No suspicion of venality, no flavor even as of affairs commercial, mercantile, or litigious, will ever be found attached to any statement of his. He was wholly free from a certain tendency to strive for triumph rather than for truth, which has sometimes been supposed to be part and parcel of an 'expert's' life, and which is undoubtedly apt to mar the statements of public analysts, and to detract from the respect and esteem in which members of the profession might well be held by the community at large.

"There is no room for doubting that Professor Nichols did earnestly desire to alleviate suffering humanity, and to support to the utmost of his power wise schemes for the better ordering of those state and municipal affairs with which chemical science or art has relations; but he had no wish for mere notoriety, or for the overthrowing of adversaries, or for the forcing of crude thoughts or schemes upon an unwilling public. That the truth would prevail in due course, he had no doubt or fear. By those of us who knew

[1] Prof. G. F. Swain. Proceedings New England Water Works Association, 1886.

him well, he will always be remembered, not only as an accomplished chemist, but a loyal, devoted friend and a thoroughly conscientious Christian man." [1]

"No labor was too hard, no effort too great, if his loved Institute was to receive benefit from it. In 1881, in consequence, doubtless, of overwork, the disease which finally ended his life attacked him, and his last five years were years of continual pain and weakness. Twice he sought relief by the aid of the surgeon's knife, but the second operation resulted fatally, and he died at Hamburg, Germany, on July 14, 1886, aged 39 years. His domestic life had been singularly happy, and to the devotion and care of his wife was due, in no small degree, the courage with which he fought deadly disease during these long years, and the determination which enabled him while an invalid to continue his work with unabated zeal. His career had been a busy and useful one, and his upright character and his love of science will continue to live in the minds and aims of the many students who came under his influence." [2]

The following extracts from the address given by Professor Nichols as vice-president of Section C, Chemistry, at the meeting of the American Association for the Advancement of Science in August, 1885, the year before his death, are given, not only to illustrate his own personal attitude, but to emphasize the definitions of sanitary chemistry and to show the directions in which its value must be recognized. The subject of the address was "Chemistry in the Service of Public Health."

In the service of sanitary science chemistry has an educational office to fill, first that of investigating the actual condition of exist-

[1] Professor Storer. Proceedings American Academy, 1886, p. 530.

[2] Prof. L. M. Norton. *American Chemical Journal*, Vol. VIII.

ing evils, second in suggesting practical remedies for existing evils, the office of chemistry being constructive as well as destructive. . . .

It will, of course, be understood that few men would choose to follow sanitary chemistry exclusively if they were ambitious of a wide reputation as chemists, if they were ambitious, let us say, of eventually receiving a foreign honorary membership in the German Chemical Society. Few men of the ability of Angus Smith would devote themselves as constantly as he to this branch of the subject. Yet it is highly desirable that even the routine work, the ordinary investigation for sanitary purposes of water, air, and food should be in the hands of the chemists well educated in their profession and imbued with the true spirit of science. It is, alas! too often the case that a smattering of the principles of chemistry and a brief course in analysis is held to justify a person in assuming the duties and responsibilities of an analytical chemist, a State assayer or a public analyst.

There are reasons why the pursuit of sanitary chemistry appears less attractive than other lines of the profession. The first is the large amount of routine work. Thus, to determine the normal composition of the air in a given locality or the slight variations which are due to changed meteorological or other conditions, there is necessity for repeated daily or more frequent analysis continued for months or even years. In the same way pollution of water or of air may be patent to the senses (especially to the so-called common sense), but the variation from the normal condition may show itself by such slight chemical differences that it can be made plain to a jury only by the evidence of a great number of analyses. . . .

Then, again, in certain lines of work, especially in estimating the amount of foreign (or certain foreign) substances in articles of food, the obligation to express an opinion with a show of accuracy about matters where accuracy is unattainable must create a feeling of disgust in the mind of a scientific man, — at least until the hardening process takes place. . . .

Again, there is the annoyance which has already been alluded to of the necessary contact with persons who are ignorant or unappreciative of chemistry or who regard it simply as a tool to subvert

personal interests. To give some sort of an understanding of the results of chemical investigations, it is often necessary to use terms which do not mean to the chemist what they are understood to mean by the layman. There is also the annoyance of having one's results and opinions quoted alongside of and as of equal value with those of some uneducated, unscientific, self-styled chemist. All this the student of pure science avoids in great measure, and one who really loves the science is tempted to retire into his scientific cell and let the world take care of itself.

On the other hand, as an offset in a certain measure to these disadvantages, there are in the field of sanitary chemistry many problems for the solution of which special and delicate analytical and other methods must be devised, which involve careful chemical work and which bring results not only interesting in themselves but of actual practical benefit to the public. The consciousness of work well done brings satisfaction if it does not bring glory. Moreover, the work of the sanitary chemist seldom ends with the results obtained; the interpretation and utilization of the results are often the most difficult part of the problem, and one with which the chemist alone is competent to deal. . . .

It is much more important for an engineer to know how properly to take samples of water for analysis than to know how the water is analyzed, more important to know how to interpret the results of analysis than to be able to perform the operations himself. . . .

If there is room in the community for a class of educated men (or women) knowing a little engineering and a little chemistry and a little biology and a little of other things, such an occupation is legitimate and honorable, but let us not call a man a sanitary engineer unless he is an engineer, or a sanitary chemist unless he is a chemist. . . .

With the chemist, as with other men, the particular line of work is not determined solely by choice but often by force of circumstances, but there is no reason why we should not all have the true spirit of science, the intelligent desire for truth as yet unachieved, searching for it as we can and making honest use of it when acquired, even if we sometimes feel that other walks in our

chosen profession are higher than those in which our own lines have fallen.

We are born men before we become scientists, and although the attractions of pure science studied for its own sake may be very great, the application of the truths acquired to the good of our fellow men ought not to be considered as in any sense belittling to our science. While all the sciences may thus be expected to contribute to the general good, there is peculiar appropriateness in chemistry being called upon to serve the public health, because many of the dangers to which the public health is liable result from the industrial and other applications of chemistry itself. One of our own poets has said, "for artificial evils, for evils that spring from want of thought, thought must find a remedy somewhere."

POST-GRADUATE WORK IN GERMANY

A Symposium

George F. Swain, S. B., '77, Hayward Professor of Civil Engineering, Massachusetts Institute of Technology

I have been asked to write a few words with reference to the opportunities for post-graduate work in Germany. I do so with pleasure, confining my remarks, however, to the Department of Engineering, and particularly Civil Engineering. Let me first state what justification I have for speaking with any degree of authority on this topic. For nearly three years I was a student in the Royal Polytechnic School at Berlin, then, and ever since, one of the largest and best in Germany. Twenty years after, in the summer of '97, I again visited Germany, and inspected several of the leading polytechnic schools for the purpose of observing what changes had taken place since my student days.

Twenty years ago, technical education in our own coun-

try was far different from what it is to-day. Immense strides have been taken within this period, both in regard to the methods of instruction and to the specialization of the teaching. It is instructive to consider for a moment the work which was being done at that time in the Institute of Technology. In 1877, there were two teachers in the Civil Engineering Department; in 1899, there are eleven. In 1877, there were three teachers in the Mechanical Engineering Department; in 1899, there are nineteen (including those in naval Architecture). In 1877, the instruction in Civil Engineering was almost entirely confined to what is contained in three books: Gillispie's Surveying, Henck's Field Book, and Rankine's Civil Engineering. The amount of time devoted to the subject of hydraulics, for instance, was not more than one quarter of the time which is now devoted to it, and the same is true of most of the other professional subjects. On the other hand, a great deal of time was employed in work which is now considered of minor importance. Similar remarks apply in a general way to the work in mechanical engineering; and similar improvements have been made in other schools in this country, most of which have greatly amplified and improved their courses of instruction within the past ten years.

Under these circumstances, a young man who desired to gain a thorough education in engineering, twenty or twenty-five years ago, found it necessary to go abroad; and the schools in Germany were considered at that time, as they are still, to be the best in Europe.

The work in a German polytechnic school at that time was of a very different character from that in most American schools. The lecture system was there employed almost universally. All the talking was done by the professor;

no text-books were used, and the students took copious notes of the lectures. I have known a young man to complete his course of four years without having a single text-book or reference book. In addition to lectures, there was work in the drawing-room and in the field. In the school at Berlin there were no examinations, with the exception of a final examination which was taken by students who wished to enter the government service, this examination requiring several days of continuous work in seclusion. The equipment of the school at Berlin at that time was about as follows: First, there were lecture-rooms; second, there were drawing-rooms; third, there were private rooms for the professors; fourth, there were collections of models. In other words, the principal difference between European and American schools consisted in the almost exclusive use of the lecture system, and in the absence of laboratories, except chemical laboratories. Other laboratories were at that time beginning to be introduced in American schools. The courses of lectures, however, covered ground much more advanced than any instruction then given in American schools. This was a natural result of the method of instruction, for the ground covered depended simply upon the rapidity with which the professor could talk, and he could continue his subject as far as the time allowed him would permit, and with no reference whatever to the amount of work which the student could do thoroughly. If the students did not understand or follow his lectures, that was no concern of his. He was there to talk; it was for the student to absorb and digest, without further instruction, the assumption being made that the students could do this. It is fair to say, however, that, on account of the excellent training which the German students received in preparatory schools, they came to the universities and polytechnic schools

knowing how to study infinitely better than was the case with American students. Their training in thinking had been given them in the preparatory schools. The lecture system, which would have been entirely impracticable here with our immature students, worked, therefore, fairly well with the older and better trained German students.

During the past twenty years, so far as my observation goes, there have been practically no changes in the German polytechnic schools. So far as concerns the instruction in civil engineering; the equipment, the methods of instruction, the specialization of the teaching, the number of courses, are almost exactly what they were twenty years ago. There is still the same absence of the laboratory method, still the same absolute reliance on the lecture system. The courses of lectures have, of course, been kept up-to-date, but their general scope appears to have been changed little, if at all.

On the other hand, the immense strides which have been made in technical education in this country have made the relation between our schools and the German schools very different from what it was. Our courses are now specialized as much as those in Germany. We have as many teachers as they. Our students have the advantage of the laboratory method, and receive a far more practical training, in the best sense of the word, than is given in the German schools. The result of all this is that there is now no need for a young man to go to Germany to study engineering. He can get here just as good a training, even a better training, and one much more suited to the conditions existing in this country. It is true that in many branches our courses are not so extended as those given in Germany, but the greater extent of the German courses is generally in one of two directions, — either that they devote greater

attention to matters of practice, that is to say, to matters of practical detail which can better be learned by the student after he leaves the school, and which, moreover, relate to the practice in Germany, which is far different from the practice in America; or that they are made to include more elaborate theoretical investigations. Of these latter, however, it may be said that in many cases they are illusory. The tendency of the German mind is to invent a difficulty and then to solve it by elaborate mathematical analysis, regarding which the engineer is never sure that the practical conditions render it correct; in fact, he may in most cases be quite sure that these conditions render it incorrect. The American engineer, on the other hand, unless he copies European methods, generally builds in such a way as to avoid the difficulty, and in most cases has no use for the elaborate mathematical analysis. Some of the theoretical courses given in Germany I am disposed to characterize as merely intellectual dissipation.

It must further be borne in mind that the student who desires to carry his studies farther than he can carry them in the regular undergraduate courses in our schools will now find post-graduate courses here which will carry him fully as far as it is desirable to go.

Let me say, then, that in my opinion the only advantage which can be gained by taking post-graduate courses in engineering in Germany at the present time, as compared with taking post-graduate courses in one of the best American schools, is the breadth and the wider view which should be gained by any one who visits and lives in a foreign country. So far as concerns the training and instruction alone, the student would do better to remain at home, and by so doing he could equip himself better to become an American engineer.

Augustus H. Gill, Ph. D., '84, Assistant Professor of Gas Analysis, Massachusetts Institute of Technology

The object of going abroad for study is to get foreign methods of investigation — not that the knowledge cannot be obtained here — and also for an opportunity for travel and art study in Europe. Rather than to go immediately after graduation, it is better to wait from two to four years, after one has had some contact with the world either by teaching or practical work, and has determined upon a specialty. The interval can advantageously be spent in completing one's preparation. This should consist of the ability to read and, if possible, speak German quickly and well. In the writer's experience the Institute degree would enable one with but slight review to pass without difficulty the examination in the side subjects, as physics and possibly mineralogy or geology. The Institute bachelor, as a rule, has a broader and more exacting training than the German doctor, but the latter has a deeper knowledge of his particular specialty.

In professional subjects, the preparation should be sufficient to enable the thesis to be commenced at once, or at the latest, two months after matriculation. In choosing a thesis it should be borne in mind that if one is selected outside the professor's subject, little attention is received from him. That which one receives in most cases from the more noted professors is at best but little, ten or fifteen minutes a week probably being a fair average; only in rare cases is the student's ideal realized, of actually studying and discussing subjects with a great man.

The thesis question is the most vexatious that the average student has to face; if it goes well there is little to mar one of the most pleasurable periods of a student's existence;

but if, as often happens, it becomes an *ignis fatuus*, leading to trifling results, nothing is more disheartening or depressing. It is the actual tangible results that are considered rather than the quantity of faithful work. I have known a student to try three different subjects, give up in disgust, and seek another university.

While it is true that investigation work and the study for the doctorate are trying and vexatious, yet without these incentives there is little to attract. So strong is the trend toward the degree, that, except in the case of mature students with special aims, those not candidates are looked down upon by their colleagues. Viewed from the standpoint either of the teacher or the practising chemist, the advanced degree is a very desirable article to possess, and worth the trouble.

Another point to be considered is the place in which to settle. The writer's preference is for a large city rather than some little "*Nest*," "which looks best when seen from one's back," as Heine said of Göttingen. The choice of lectures is much larger, and there is also the opportunity of relaxation or recreation in the shape of operas, concerts, or plays. Then too, one is more likely to meet English-speaking people, who are not to be avoided like the plague, as is too often done by our students. I look back upon the time spent at the meetings of the "American Students' Club of Leipzig University" as more profitable, as well as enjoyable, than the same number of hours would have been if devoted to lonely study or thesis work.

Regarding the other object, that of travel and art study, ample opportunity is offered in vacations; more benefit and enjoyment are obtained from it in this way than in six months of continuous travel. Holland, Belgium, and the Rhine can be included on the trip over; South Germany and Italy at

an Easter vacation; Austria, Switzerland, and Paris in the summer; Turkey, Greece, or Spain at another Easter; Denmark, the Scandinavian peninsula, and Great Britain on the homeward journey. The Christmas and Whitsuntide holidays will afford opportunities for seeing the North German cities, the Harz, Thuringian, or Black Forests, or the Tyrol.

In the matter of expense, a thousand dollars a year should be sufficient; board and clothing cost about the same as in this country. University fees amount to about seventy-five dollars per year, and laboratory supplies fully as much more, the student owning nearly all the apparatus. For travelling expenses, after the usual manner of American students, three dollars per day is an ample allowance.

Arthur A. Noyes, Ph. D., '86, Associate Professor of Organic Chemistry, Massachusetts Institute of Technology

The comparative benefit to be derived from post-graduate study in Germany and at the best institutions in this country is a question so often asked by students of physical science intending to continue their education beyond the usual curriculum of colleges and technical schools, that a brief discussion of it may not be without interest. The nature of the scientific work pursued at the foreign and American universities is nearly the same, consisting in both cases, in the main, of original investigation in the laboratory of problems of pure science, and of attendance at thorough or advanced courses of lectures. The difference, so far as any exists, is therefore one of details in method and facilities rather than in kind.

The lecture courses offered at German universities, with the exception, perhaps, of those at the large University of

Berlin, include but few subjects of an advanced character, so much so that it is not an exaggeration to say that even the *under*-graduate courses in chemistry and physics, given at the Institute of Technology and some other colleges, are more various and more highly specialized than those offered at most German universities. Moreover, the special advanced courses that are offered in Germany are almost invariably given by the younger members of the staff of instruction, by the docents, and not by the professors.

As to laboratory equipment and convenience of appliances for research work, — a matter at best of minor importance from an educational point of view, — it would seem that no decided advantage exists on either side; for, though American laboratories are, as a rule, more modern, more conveniently arranged, and more elaborately equipped, yet this is fully compensated in Germany by the greater ease of obtaining the special supplies needed in research, like the rarer chemicals and unusual forms of apparatus, and by their greater cheapness.

In one respect, however, greater benefit is apt to be derived from investigation work in Germany than from that in this country, the student being more likely to become imbued with the spirit of scientific research, working as he does with the leading men in science, who have made such research their life-work, and under an educational system of which it forms the main part; his own degree, too, is principally dependent on the success of his own investigation. It is true, to be sure, that there are one or two institutions in this country, where post-graduate study has been highly developed, where the scientific atmosphere is fully as invigorating as that of the German university.

The scientific knowledge and training to be acquired at the *best* universities in the two countries do not seem, therefore, to differ enough to warrant a definite conclusion as to the best place for post-graduate study. There are, however, other considerations of great importance, which are of assistance in making the choice. German study has, undeniably, the following incidental, but by no means unimportant, advantages. In the first place, the student acquires so thorough a knowledge of the language that the German scientific and technical literature connected with his profession is readily and unhesitatingly consulted by him, while it is unfortunately too apt to be ignored by the student educated in America, in spite of the fact that it includes, in the case of chemistry at any rate, by far the larger portion of all the work published. Secondly, residence in a foreign country for the period of two or three years, and the opportunity for travel in neighboring countries, which the vacations afford, serve in many ways to enlarge the young man's experience, broaden his ideas, and increase his general information and culture; thus he can hardly fail to acquire valuable information bearing on social and governmental questions, to become acquainted with new phases of industrial development, and to learn better to appreciate and enjoy the various forms of art, such as music, architecture, and painting. His period of study abroad thus embraces a variety of experiences, which he is likely to look back upon with pleasure during his whole life. Thirdly, the acquaintance with the details of a new system of education is of not inconsiderable value to those intending to become teachers.

On the other hand, it must be recognized that there is, in case of young men whose strength of character is not beyond question, considerable danger connected with study

abroad, by reason of the nearly complete removal of the stimulating and restraining influences which the desire for the good opinion of parents, teachers, and fellow students exercises at home, a danger increased by the complete absence of supervision and frequent lack of personal interest on the part of the university instructors. With students of certain dispositions, too, it not unfrequently occurs that they become discouraged over the slow progress or apparent hopelessness of their investigation, and then fritter away their time in outside pursuits. In a word, the German experience is an ordeal which develops those who are adapted to it into stronger and more independent men, but one which may produce detrimental results in the case of those lacking scientific interest, definiteness of purpose, perseverance, and a sound moral character.

The statements of the last paragraph, however, are made for the purpose of impressing the student intending to study abroad with the necessity of approaching his work with seriousness and with an earnest determination to succeed, rather than to dissuade him from the undertaking. For it is the advice of the writer to almost any young man to study abroad by all means if he has the opportunity, not so much on account of the additional chemical or physical knowledge he may obtain, though this is, of course, important, but because of the great educational value, in a broader, more general sense, connected with such study.

Heinrich O. Hofman, E. M., Met. E., Ph. D., Professor of Metallurgy, Massachusetts Institute of Technology

This contribution to the general discussion aims only to consider the question with reference to the graduate of the Mining and Metallurgical Department of the Institute.

Will it be an advantage to him to visit Germany for post-graduate work, and, if so, at what period after graduation will he be likely to obtain the best results in return for his expenditure of time and money?

There is no question that study at one of the German universities or mining academies will act as a broadening influence, but to produce the best effect it should proceed upon certain definite and restricted lines, *i. e.*, those upon which his previous studies have been carried on. Otherwise the effect is rather to fritter than to concentrate the energies.

Quite a number of Institute graduates from the departments of physics and chemistry, after having served a year or so in the capacity of assistant or instructor (during which time they found opportunity to round out their knowledge and experience), have gone to German universities and returning with the degree of Doctor of Philosophy have adapted their new knowledge to our requirements and become excellent teachers in their several branches, and sometimes very successful investigators. It has been thought that the same, or similar, advantages would be gained by graduates of the several engineering courses, and perhaps especially by students in mining engineering and metallurgy. The German mining schools, founded, some of them, centuries ago, have very elaborate and highly specialized courses given by professors whose names are of world-wide reputation. Besides coming under the influence of these powerful minds, the student also has the advantage of working under new conditions and unaccustomed professional surroundings. These considerations are all true and important. Nevertheless, some of the deductions from them have not proved correct, and the practical results have often been disappointing. The trouble is that

a young man does not know how to choose the branches which he is best fitted to make specialties of unless he has proved himself and acquired experience in practical work. Supposing him to have graduated after the usual four years, it is a decided advantage, if he can take a short post-graduate course in his own college, or as assistant or instructor to pursue his work further, under the same conditions, before he goes into practical work. All scientific studies, theoretical as well as applied, are developing so rapidly that it is almost impossible to acquire even the leading principles and facts in the allotted school time, and this is especially true for the student of mining and metallurgy. By remaining connected with his college in some capacity or other, the graduate has the necessary opportunity to find out his own real tastes and capacity, and to enlarge upon the studies in which he has already fulfilled his college's requirement, or he can take up affiliated studies and broaden the foundations upon which he is to build his future career. Supposing him to have done this, will it be of advantage to him to go then to Germany for further post-graduate work? To this the writer would unhesitatingly answer: "Not until he has first had some real experience in practical work." The theoretical knowledge must be tested, applied, developed, before he is fitted to take up new theoretical study with profit. When he is ripe for this he may go to Germany. Unfortunately, most of the instructors in mining and metallurgy in our American schools have so many subjects to teach that they cannot devote themselves to specialties. In Germany, as has been pointed out elsewhere[1] by the writer, the method of teaching is entirely different from ours, being almost exclusively by lectures, while ours is largely in the laboratory. An American grad-

[1] *Engineering and Mining Journal*, 1898, 63, 231, 328, 423.

uate will gain very little if he simply attends the general lectures on mining and metallurgical subjects. It may be interesting for the sake of comparison of methods, but will be of little use for the acquirement of additional knowledge. The American student should confine his attention to specialties and choose the school where he can find a professor prominent in whatever branch he wishes to follow up. If he has clear aims and is capable of working independently, he will be sure to find encouragement and assistance in the prosecution of his studies. These, however, should be, as much as possible, along theoretical lines, bringing practice in only when it is absolutely necessary, as the details of practice in Germany are so different from those in America that they are of little benefit to the American student.

COMMENCEMENT WEEK

The various functions of the week were begun most pleasantly on the evening of Friday, June 2d, with the reception to the class of '99 by the alumni, at the Exchange Club. After supper, addresses were made by Edwin C. Miller, '79, President of the Alumni Association, Prof. William H. Niles, of the Faculty, Col. Thomas L. Livermore, of the Corporation, and Arthur L. Hamilton, president of the class of '99.

On the following evening a concert was tendered to the Senior Class by the musical clubs, to the great enjoyment of all present.

The covers of the programmes bore a design in class

colors by H. S. Graves, '99, and their contents were as follows:

PROGRAMME

PART I.

1. Marfa's Wedding Day . . . . . C. D. Underhill, '85
   Arranged for the Club.
   Glee Glub.
2. South Car'lina Sift . . . . . Tracy
   Banjo Club.
3. Night Off . . . . . Rosey
   Mandolin Club.
4. '99 Quartet . . . . . Selected
   Messrs. Adams, Pierce, Page, Johnson.
5. Dance at Twilight . . . . . Lansing
   Banjo Club.

PART II.

6. Fortune Teller . . . . . Herbert
   Mandolin Club.
7. Little Cotton Dolly . . . . . Giebel
   Glee Club.
8. Guardmount in Darktown Patrol . . . . . Lansing
   Banjo Club.
9. Solo . . . . . Selected
   Harry George Johnson, '99.
10. Boston Tea Party . . . . . Pryor
    Mandolin Club.
11. Continuous Performance . . . . . Gottschalk
    Glee Club.

The Baccalaureate Sermon was preached by the Rev. E. Winchester Donald, in Trinity Church, June 4, 1899.

Psalm cxix. 47: "I will delight myself in thy commandments, which I have loved."

Once more the Church welcomes beneath its roof a company of men and women who, having finished years of ardent study and severe academic discipline, are met together voluntarily to ask God's

blessing upon the future, which stretches out temptingly before them. For I have the right to take it for granted that you are here solely to testify to yourselves, at any rate, that you recognize the value of God's blessing upon the unknown future of your lives; and I have no right to interpret your presence here in more specific terms. You belong to widely differing ecclesiastical communions. Some of you disclaim allegiance to, or even sympathy with, any of the various ecclesiasticisms which, together, make up the great total body of American Christianity. It must needs be, therefore, that our theme this afternoon shall be one in which each of us is capable of sympathetic interest; one which makes its appeal to us as members of the human family, irrespective of our particular denominational affiliations, or lack of them.

The Massachusetts Institute of Technology is reputed to stand in the front rank of our educational institutions in exacting from its students the maximum of obedience to its serious, lofty, exigent standards of intellectual discipline. Its reputation is deserved. It is not extravagant to assert that it is easier for a camel to go through the eye of a needle than for an idler or a trifler to pass through the Massachusetts Institute of Technology. Very likely it is this notable circumstance which has largely determined me to speak to you of the Joy of Living under Law. . . .

The same is true of the unwritten statutes of society. More rigid, more merciless and irritating they seem at times to be than those of the State. Social custom is more imperious than a municipal ordinance. Its penalties for dishonor, untruthfulness, and treachery are very heavy, and with unpitying sternness are inflicted. Our whole social life is imperiously charactered and shaped by law. Restraint is everywhere. There is much which is petty and conventional about it all, but it is so inextricably bound up with what is everlastingly wholesome and necessary, that no wise man will break through social sanctions, or can safely defy them. Is it nothing to delight in that society demands loyalty and decency of us? Is it nothing to delight in that if we are to retain our social place we must be honorable, truthful, compassionate? Is it a trifle to be glad for that without these strenuous social sanctions there

would be nothing to confide in, nothing to praise, nothing to appeal to when personal experience, finding the walls of individuality too confined, craves sympathetic relations with the larger life of society? Yea, verily, we delight in every social statute which guarantees the perpetuity of associated life even while restraining the freedom of the individual.

And this delight is distinctly increased when one reflects upon the purpose of social commandment. Society is wiser than any one of its members. It has penetrated into the very heart of man's social life, sought out the causes of disaster, disgrace, and danger, treasured the lesson drawn from a million separate careers, and then resolutely set itself to incorporate into rule the wisdom of the years. We may fault it for a thousand foolishnesses, none the less it is wise. But you and I are tempted to say: "Why should I permit myself to be shorn of my freedom to be myself by these exasperating rules? They were made for the bad, the cunning; not for me, honorable, pure, and strong." Ah, but society is wiser than we. It knows with unerring certainty that what we would not do we may do. Side by side with the safety of those who obey its laws lies the ruin of others, once pure and strong, who defied and broke them. The insurgent heart of more than one Jude the Obscure has been battered, and broken, and stilled forever in wild rebellion against the accredited wisdom of society. And when one reflects ever so little upon the multitude of men and women shielded by these social commandments from the perils of their own weakness or badness, and from the cunning, evil fascination of others; or when one thinks of that miserable company of ruined souls who, trusting to the infallibility of their own judgments and the purity of their own intentions, despising the larger wisdom of society, have made their own laws, framed their own maxims of social conduct, only to make shipwreck at the last,— surely we can delight in the commandments and statutes of society, and rejoice that our lives must be lived under their sway. What restrains us we rejoice in, what controls the freedom of our acts we are glad for, when we see what disobedience may bring, and what obedience secures.

So is it that absolutely unrestrained life is anything but best. Therefore, when we hear God's commandment laying upon us the austere duties of justice, truth, compassion, reverence, and acknowledge that through the exercise of these, life's noblest powers are developed and refined, we ought to rejoice. But too often we complain that we are under law; complain that what that law enjoins is hard. It is burdensome and irksome everlastingly to struggle for what is just, and pure, and true. Why must inclination forever meet the unyielding opposition of commandment? Why must desire be controlled by the heavy hand of law? Why must sacrifice be the inexorable condition of noblest life? And the answer is, because God wishes us to become like unto that pattern of the perfect man whom the world sees in Jesus Christ. It is when the ideal is clearest that delight in whatever helps us to reach the ideal is deepest. Then there is nothing in all the world with which a man would not gladly part rather than lose his consciousness of being a true man through and through. And when a man is wavering, when his weakened will is on the brink of consenting to the fatal plunge into the godless deep, how grateful is he for the uncompromising commandment which cries out, "Thou shalt not;" and the man stands up and says, "I cannot do this thing and go into the presence of God."

Again, it is worth our while to recognize that when we complain that serving God is hard, when we resist his laws, we are really fighting against the permanence of truth and goodness. For God is not a "languid dilettante, a magnificent Laodicean, a somnolent potentate, who is half-hearted in his care for distinctions between right and wrong." He has not chosen that truth should be a whim, or goodness a fancy dependent upon the shifty inclinations of men. He has grounded them in eternity, made them imperishable by the law which utters his own life and nature. The law certifies that truth is truth forevermore; that goodness is from everlasting to everlasting. The punishment which smites disobedience certifies that the truth which the commandment guards is eternal; that with God and the life he is disciplining there is no perhaps. It admonishes that no man can disobey and

be safe according to his own notions of safety. It disarms the fascinations of sin, rouses us from the dull narcotic of pleasant, respectable, easy-going wickedness, and bids us recognize that to miss the reward of obedience is to bear the penalty of revolt. For God will not let us alone. If we refuse to use the divine fire of awe and reverence which burns in the heart of every man that cometh into the world, in accordance with the law of its being, it will consume us. If we rebel against his wholesome discipline it will crush us. He lays great burdens on our shoulders that we may come to the proud consciousness of our strength. So always he treats us, seeking ever to make us, through this statutory discipline, strong, brave, pure, reverent, just, and compassionate; skilled in the art of living helpfully and happily with our fellows, and meet for citizenship in the New Jerusalem, toward which the race from the beginning has, with varying fortunes and variant hopes, toilsomely pressed.

Oh, blessed law of God, coming down from heaven out of the bosom of the Father, incarnate and perfectly fulfilled in the life of the Son, and through him lifting us, the children, out of the flaccid ease of uncontrolled desire, setting our feet upon the immovable rock of eternal truth, — surely in thee is our delight; to thee we owe our grateful love!

Members of the Senior Class, to-day you stand with the hard-won instruments of a serviceable career in your possession. A just pride, a happy contentment is yours as you recognize that you have earned your skill and knowledge. They are yours as the result of a long, patient, intelligent obedience to the inflexible rules of the Institute. Day by day the firm hand of law has been upon you. It conquered your moods, helped you to care for your health, prevented the waste of many a half-hour, kept you at your tasks. How you rejoice in those imperious laws to-day; how grateful you are that good nature or weak pity never relaxed them. With rare intelligence you can say of the wise, firm rule of the Institute, "I delight myself in her commandments, for they have enabled me to call my intellectual soul my own."

Out into the world you go with the instruments of power in

your hand. The Church of God bids you resolve to use them in obedience to his commandments, for you are going into the world with the power to bless or curse it. It stands in sore need of your ripe knowledge and expert skill. What will minister to its physical comfort and convenience, to its yearning for beauty, to its eager wish for the machineries through which unused force shall serve its growing needs, and to its hunger for the exact knowledge which shall prevent its ignorant blundering, is only yet discovered. You are the discoverers of the future. One of you will outdistance a Bessemer, an Edison, a Howe, a Whitney. Yes; but the world is in sorer need of more men and women who to cleverness, skill, and invention shall add unbroken obedience to that law of God which bids us exalt truth, justice, reverence, sacrifice, and compassion above invention, skill, and cleverness, that these last may be man's blessing and not his curse. That you may so exalt God's law and find it a delight is the prayer which the Church of the living God prays for you as you clasp hands, break ranks, and fare forth into the tumult of the world.

Class-day exercises were held in Huntington Hall, which was pleasingly decorated for the occasion. By two o'clock, the hall was filled to overflowing with friends of the seniors, and a few minutes later the Class-day officers and committee took their places on the platform.

The officers were: First marshal, Kenneth Mallon Blake; second marshal, Edward Hosmer Hammond; third marshal, William Stark Newell; president of class, Arthur Little Hamilton; historian, Lane Johnson; statistician, William Malcolm Corse; prophet, Walter Owen Adams; orator, Harry Leonard Morse.

The members of the committee were: Francis Minot Blake, William Burwell Flynn, Frank Fuller Fowle, Benjamin Prescott Hazeltine, Jr., Alexander Rieman Holliday, William Abbot Kinsman, Benjamin Eames Morse, Stanley Motch, Charles Barnard Page, Miles Standish Richmond,

Haven Sawyer, Miles Standish Sherrill, Gerald Basil Street, Etheredge Walker.

The addresses of historian, statistician, prophet, and orator were happily received, and may be found in full in the Class-day *Tech*, to whose journalistic energy and courtesy we are indebted.

The graduation exercises of the Senior Class were held on Tuesday, June 6th, in Huntington Hall. They were similar, in their simplicity and informality, to those of other years. The hall was filled with the guests of the Institute and with the parents and friends of the graduates.

Theses, representative of the work in the various courses, were read as follows:

Course I. — John Berton Ferguson, Plan for Separation of Grades at Arlington, Mass. (With C. W. Brown.)

Course II. — Benjamin Stearns Hinckley, Tests on a 12-Wheel Compound Freight Locomotive on the Boston & Albany R. R. (With H. A. B. Campbell.)

Course III. — Sylvester Quayle Cannon, Treatment of a Low-grade, Gold-bearing Silver Ore.

Course IV. — Almeron W. McCrea, B. S., A Design for the Residence of the American Ambassador at Paris.

Course V. — Harry Solomon Mork, Analysis and Conditioning of White and Colored Silks.

Course VI. — Clarence Renshaw, Design and Construction of an Apparatus for the Study of the Alternating Current Arc. (With N. E. Seavey.)

Course VII. — Bertha L. Ballantyne, On the Influence of Changes of External Temperatures on the Capillary Blood Pressure in the Skin.

Course VIII. — William Otis Sawtelle, A Study of the Electrical Resistance of Metallic Films.

Course IX. — Amasa Amidon Holden, A Study of the

Methods Used in Passing Congressional Appropriation Bills, illustrated by Legislation of the First Session of the Fifty-fourth Congress, from Dec. 2, 1895, to Jan. 11, 1896.

Course X. — Charles Burton Gillson, A Study of Lead-Tellurium Alloys.

Course XI. — Philip Burgess, A Study of the Sewerage Systems of South Framingham and Natick. (With B. Herman.)

Course XIII. — William Stark Newell, Progressive Speed Trials of Steam Yacht Kaleda.

President Crafts's address was as follows: —

A friendly and appreciative audience of your classmates, your parents, relatives, and friends, have had the satisfaction of listening to some simple descriptions of the researches which form the crowning tasks of your school career, and which are in some degree the tests of your capacity for original work and of your fitness to go on without guides in the active, competitive life before you. The papers read give an excellent idea of what you are trying to do, and how you are trying to do it; but something may be added to the story, and I will ask a few minutes of the patience of the audience to say, as your spokesman, some things which you cannot well say about yourselves. I wish particularly to speak of the spirit which has animated the good work which you have just been describing in the brief formulæ of scientific terms.

The statistical people tell us that the measure of civilization in the world to-day is the use of iron; Liebig said soap was the standard, but probably iron is now a better one, and, as usual, such statistics are brought forward for self-glorification, and we are told that the United States and England lead the world with three hundred pounds use of iron per capita per annum, while Asia sinks to a few pounds, and perhaps Africa to some ounces per head.

If this measure of civilization is correct, it is worth while to see how we ourselves are measured by it. It is needless to say that

three hundred pounds of iron are not weighed out each year to each individual; it would be an embarrassing present to some, and far too little for others; and here is where we come into the story and play our part as the leaders of civilization and the ministers of this iron mission to the world. You miners and smelters are to dig the ground for coal or iron ore and limestone, and raise iron pigs almost as easily as the great American corn crop is converted into living pigs. You will have a constant and ready market for your pigs. You will not find yourselves obliged to call in the aid of the skilled diplomatists who are now trying to persuade our German brethren to eat American pork products. Or perhaps you will produce your quantum of iron indirectly by mining gold, silver, or copper to pay for iron. You will distribute your product to your fellow workers, the civil, mechanical, and electrical engineers who will roll it into rails, or fashion it into engines, or draw it out into slender wires, or to the naval architects who will plan our ships. These all serve one common purpose to bring man nearer unto man. You are advancing art as well as civilization, for the architect, from the days of Michael Angelo to the present time, is an engineer as well as an artist, and the three hundred pounds of iron measured out for his use enables him to solve many problems which appeared impossible to Angelo or Wren; and skill in iron working has from all time been a title to distinction, for although there are more carpenters than smiths in the world, Smith is the distinctive name most often handed down from father to son.

Such, then, is the brief story of your work if we take a single material and a single use of it for the sake of simplicity of treatment, but it is easy to see what are the contributions to this work of civilization of the chemist and the physicist, who provide the original data upon which the metallurgist and the engineer are working, and how, also, at the base of and pervading all calculated knowledge is the abstruse work of the mathematician, whose forms of expression are as essential to scientific thought as a common language is to human intercourse.

Then, again, the transformation of a shovelful of iron ore into

a bit of steel rail, a bundle of needles, or watch springs, can only be done economically by large associations of men in settled and well-organized communities, and the work of the sanitary engineer, the political economist, and the historian are obviously essential to a knowledge of the laws of health and order which must regulate such communities.

You who are equipped with this knowledge, and are handling these materials, are going to do this work of civilization for the thousands of men, women, and children who are incapable of doing it for themselves, and your names will be graven upon the corner-stones of new edifices, which will change the aspect of the world before you are old men; and we shall look with pride upon your success, — we who have, step by step, built up a school, adding, as we saw the need of it, each thing which we thought necessary to enable you to be the architects of new structures, and incidentally to be the architects of your own fortunes.

I will not deny that iron construction may be abused, as well as used, but the same is true of most good things, and I will not turn aside to argue with those followers of Ruskin who assure us that railroads lead civilization backwards.

It is difficult to offer convincing proofs to the type of mind which worships the beautiful, and thinks its production a lost art. I think, however, that Leonardo da Vinci, or Sir Christopher Wren, the friend of Watt, would have said that beauty can be engineered as well as imagined, and I see in many modern works a beauty and a progress in the thoughtful adaptation of means to ends. Certainly such adaptation is a progress, and one most needed in our American civilization, where the wastefulness of our processes strikes all experienced observers. You know that it is your business as engineers to count the cost before you build your tower, to use just the right quantity and quality of material, and your education fits you for a most important mission to your fellow countrymen. Go and teach the doctrine you have learned; persuade the farmer to save the useless sacrifice of beasts of burden upon the worst graded roads in the world, to cut his forests so that some trees will be left for coming generations. You chemists

may even have a word to say to our Congressmen, and tell them to prepare for war as soon as the fighting mood comes on, by getting their powder ready. You can tell them that Chili saltpetre and cotton exist upon this Western Continent, and the skill to transform those materials into smokeless powder also exists here.

I suppose that the next war will not find us unsupplied with this particular article, and the next time we besiege a town it will be with heavier artillery, and perhaps a lighter general; but I fear that for a long time to come those who vote our budgets will still be improvident of the future, and indisposed to listen to the opinions of experts. Yet all prudent men are moving in the opposite direction. The railroad which formerly could not afford to employ engineering skill now cannot afford not to. Every enterprise, large and small, is going to recognize the value of your trained knowledge, and to use your services more and more; but those conducting the greatest business of all, that of governing seventy millions of people, are slow in recognizing that professional methods and close calculations are everywhere pushing aside guess-work business.

I think that you have a peculiar claim to be heard. There are experts of all kinds who are pronouncing opinions on all subjects, from religion to guncotton, and many of them discredit expert testimony; but you, scientific men, have learned methods and are working in fields where your work will speak for you; and nothing is easier to test and recognize than the value of the products which you turn out.

Your success will not only turn to your own profit, but also, as citizens of a great country, you may hope by your individual efforts to gain over men to the belief that it pays to educate employees for every task which they have to perform; and if we are to enter upon a great colonial policy, the moment is pressing for the recognition of the truth by every citizen.

Yet, in bidding you farewell, I care very much to say to you that the things which I have described make up the smallest part between an educated and an uneducated man. Education is very much a matter of influence, or contagion, from man to man; and

in this scientific school the relation between teacher and scholar grows closer, and oftentimes more friendly, toward the end; because in the small laboratory or class-room sections you find yourselves trying to pass beyond the boundaries marked out by routine and text-books, and, in companionship of your teachers, trying to discover something new. This is the chief end of education; not so much to make you learned as to make you original, and to stand you on your own feet. The aim is the same in every branch of knowledge; but the discipline of science has thus far been most successful in attaining this result, by means of her wonderfully organized system for selecting the problems which we are prepared to solve, and for testing the absolute accuracy of the solution.

The genius of Aristotle, Bacon, Galileo, Newton, has built up for you a heritage which not only is unimpaired, but has had compound interest added through the ages. It has been our business to seek to put you in possession of this body of scientific methods for using the known to find out the unknown, and so far as may be to direct you in their application.

One thing more only will I say, and that is that you must have felt that the key to success in scientific work is a love for the truth.

As the love of money is the root of all evil, so the love of truth for its own sake lies at the root of all good, and the successful, well-organized search for what is absolutely true is the most joy-giving and satisfactory occupation that a man can engage in.

You go out from here to all the ends of the earth, having had less class companionship than in many a college, but you go to a closer companionship than exists among most college alumni, because you bring more directly every day into use what you have learned here, and well learnt, since: unlike many college students, you knew exactly what use it was going to be while you were learning. But, above all, if you pursue science with its highest aims ever before you, that common purpose in life will form, and does form, the closest bond that can bind alumni together.

You know that the occasion is not held to be a ceremonious one, and it is not well to speak as if we were not to see each

other again. I hope the high aspirations with which you are beginning a new career will be fulfilled, and that you will come back to your Alma Mater to let us hear of your success; and those of you who cannot come in person will ever keep in communication with your old school.

Last Friday you received a hearty welcome from the alumni, and to-day we feel that we are not bidding you good-by, but rather that the diplomas just handed to you are certificates of membership in the larger society of sons of the Technology, and that you are joining together to work for your school as your school has worked for you.

You will always have our active interest and good wishes, and we also feel certain that you will not forget your Alma Mater.

After the exercises President and Mrs. Crafts received the guests in the new general library, in Rogers Building, a fitting and beautiful room for the purpose.

CANDIDATES AWARDED DEGREES IN THE SEVERAL COURSES OF STUDY, WITH TITLES OF GRADUATION THESES.

THE DEGREE OF MASTER OF SCIENCE

Daniel Wilbert Edgerly, S. B., Cambridge, Mass. An Investigation of New Methods for Determining the Atomic Weight of Tellurium.

Gorham Phillips Stevens, S. B., Cambridge, Mass. An Investigation of the Stresses of a Steel-framed Dome and a Design for the Framework.

Charles-Edward Amory Winslow, S. B., Boston, Mass. Experimental and Statistical Studies on the Influence of Cold upon the Bacillus of Typhoid Fever and its Dissemination, with Special Reference to Ice Supply and the Public Health.

THE DEGREE OF BACHELOR OF SCIENCE

Lewis Benjamin Abbott (IV), Danvers, Mass. A Design for a City Church.

Herbert Henry Adams, B. A. (I), New York, N. Y. A Study of Modern Developments in Air Brake Practice.

John Howard Adams (IV), Pawtucket, R. I. A Design for a Post-office.

Walter Owen Adams (X), Gloucester, Mass. An Investigation upon a Modification of Huebl's Method for Iodine Numbers.

Lawrence Addicks (II and VI), Philadelphia, Pa. 1. A Determination of the Distribution of Steam in a Water Gas Plant (*With H. P. James*); 2. Tests of a Rotary Converter (*With H. P. James*).

James Walter Allen (VI), Newtonville, Mass. Stray Power Variations of Direct Current Motors (*With G. D. Emerson*).

Harold Osgood Ayer (V), Danville, Vt. An Investigation on the Colored Oxidation Products of Methylenediorcine.

Thomas Wendell Bailey (IV), Boston, Mass. A Design for a Public Library for a Town of the Size of Brookline.

Bertha Lennie Ballantyne (VII), Hudson, Mass. The Effects of Changes in External Temperature on Capillary Blood Pressure in the Skin.

Walter Raymond Bean (XIII), Roxbury, Mass. A Design for a Lake Freight Steamer (*With R. B. Wallace*).

Raymond Franklin Bennett (I), Portland, Me. An Experimental Investigation of the Efficiency of Tackles (*With A. B. Foote*).

Carroll Augustus Bennink (IV), Cambridgeport, Mass. A Design for a State House.

Newton Davis Benson (IV), Providence, R. I. The Structural Design of a Railroad Terminal Station.

George Edwin Bergstrom (IV), Neenah, Wis. A Design for an Athenæum for a City.

Arthur Eliot Blackmer (I), Plymouth, Mass. An Investigation of the Water Supply of Beverly, Mass., with Reference to the Efficiency of Fire Protection (*With W. A. Price*).

Francis Minot Blake (II), Boston, Mass. An Investigation of the "True Line of Resistance" in a Masonry Arch (*With W. A. Kinsman*).

Kenneth Mallon Blake (II), Newton, Mass. An Investigation

of the Variation of the Coefficient of Friction between Leather Belting and Cast Iron at Different Speeds of Slip (*With H. Sawyer*).

Walter Weidenfeld Bonns (IV), Milwaukee, Wis. A Design for a Market for the Residence Section of a City.

Arthur Harrison Brown (II), Reading, Mass. An Investigation concerning Explosive Mixtures.

Carroll Wilder Brown (I), Rye Beach, N. H. A Plan for the Abolition of Grade Crossings on the Boston & Maine Railroad at Arlington, Mass. (*With J. B. Ferguson*).

Philip Burgess (XI), Newtonville, Mass. A Study of the Sewerage Systems of South Framingham, Mass., and Natick, Mass. (*With B. Herman*).

Frederick William Caldwell (II), Winchester, Mass. An Investigation of the Initial Stresses in Steel Shafting Due to Forging.

Harry Andrew Bach Campbell (II), London, Eng. Tests on a 12-Wheel Compound Freight Locomotive of the Boston & Albany Railroad (*With B. S. Hinckley*).

Willard Telle Cannon (II), Salt Lake City, Utah. Coefficients of Discharge of Nozzles (*With F. A. Watkins*).

Herbert Monroe Case (VI), Hartford, Conn. A Method for Measuring the Angular Variations in Speed of Fly-wheels and Armatures (*With J. A. Flemings*).

Edna Matilda Chandler (V), Roxbury, Mass. An Investigation of Distinctive Qualitative Reactions for a Few Important Organic Compounds.

James Finlay Chapman, S. B. (VI), Mankato, Minn. A Comparison of Various Photometers (*With W. W. Wells*).

David Carroll Churchill (II), Oberlin, Ohio. An Experimental Determination of the Speed Variation of a Gas Engine (*With J. K. Clark*).

Frederick Otis Clapp, A. M. (I), Providence, R. I. An Investigation of the Loss of Energy at Branch Connections in Water Mains (*With R. W. Loud*).

James Kenneth Clark (II), Warren, Pa. An Experimental Determination of the Speed Variation of a Gas Engine (*With D. C. Churchill*).

Clarence Brooks Cluff (V), Haverhill, Mass. An Experimental Investigation on the Correctness of Certain Thermodynamical Equations Pertaining to the Heat of Solution of Dissociated Substances.

John Elliott Congdon (II), Fall River, Mass. A Design for a Thrown-silk Mill.

Herbert King Conklin (IV), Newark, N. J. A Design for a City Hall for a City of One Hundred Thousand Inhabitants.

George Irving Copp (II), Cambridgeport, Mass. An Investigation of the Compression on the Bearing Surface of Riveted Joints (*With J. G. Leiper, Jr.*).

William Malcolm Corse (V), Medford, Mass. The Decomposition of Diazobenzene Sulphate with Phenol in Hot Solution.

William Lehmer Curry (VI), Pittsburg, Pa. An Investigation of the Mordey Alternator (*With W. B. Flynn*).

Harvey Morse Cushing (VI), Ottumwa, Iowa. The Design and Construction of Three-phase and Phasing Transformers to Illustrate Polyphase Distribution (*With E. A. Regestein*).

Harry Sumner Damon (II), Bryantville, Mass. A Study of "Slip" and "Creep" of Leather Belting (*With F. A. Fifield*).

Henrietta Cutting Dozier (IV), Atlanta, Ga. A Design for a Small Palace for Receptions and Balls.

Charles Davis Drew, A. B. (I), West Newton, Mass. A Plan for the Abolition of the Grade Crossings on the Boston and Albany Railroad at Newton Centre and Newton Highlands, Mass. (*With F. R. Sites*).

Henry Charles Eaton (II), Waltham, Mass. The Density of the Steam Injector Jet (*With A. W. Grosvenor*).

James Benjamin Ellery (V), Annisquam, Mass. An Investigation of Some Derivatives of the Fatty Amines.

George Dana Emerson (VI), Denver, Colo. Stray Power Variations of Direct Current Motors (*With J. W. Allen*).

John Berton Ferguson (I), Woburn, Mass. A Plan for the Abolition of Grade Crossings on the Boston & Maine Railroad at Arlington, Mass. (*With C. W. Brown*).

Leonard Hamilton Field, Jr., A. B. (IV), Jackson, Mich. A Design for a Church.

Frederic Alonzo Fifield (II), Methuen, Mass. A Study of "Slip" and "Creep" of Leather Belting (*With H. S. Damon*).

John Albert Flemings (VI), Lowell, Mass. A Method for Measuring the Angular Variations in Speed of Fly-wheels and Armatures (*With H. M. Case*).

William Burwell Flynn (VI), Bridgeport, Conn. An Investigation of the Mordey Alternator (*With W. L. Curry*).

Arthur Burling Foote (I), Grass Valley, Cal. An Experimental Investigation of the Efficiency of Tackles (*With R. F. Bennett*).

Frank Fuller Fowle (VI), Brookline, Mass. An Investigation of Parallel Operation and Synchronizing of Two Similar One-horse Power Rotary Converters.

Gardner Manning Gale (IV), Olean, N. Y. A Design for a City House.

Charles Burton Gillson (X), Evanston, Ill. A Study of Lead-Tellurium Alloys.

George Curtis Glover (IV), Melrose Highlands, Mass. A Design for a Public Bath and Gymnasium.

Harry Wales Goldthwaite (II), Brighton, Mass. Tests on an Air Condenser and Steam Heater (*With B. E. Morse*).

Herbert Chester Greer (III), Newcastle, Pa. Smelting an Oxide Copper Ore and a Pyritic Concentrate.

Asa Waters Grosvenor, B. S. (II), Amherst, Mass. The Density of the Steam Injector Jet (*With H. C. Eaton*).

Frederick Warren Grover (VIII), Lynn, Mass. The Effect of Temperature, Concentration, and Magnetism on the Formation of Colloidal Ferric Hydrate.

Edward Hosmer Hammond (V), Newton Centre, Mass. The Determination of Rosin in Varnish.

Ross Hasbrouck (I), Poughkeepsie, N. Y. A Design for a Steel Railroad Viaduct, 500 Feet Long.

Lawrence Ashley Hawkins, B. A. (VI), Pittsfield, Mass. Electrolytic Rectification of an Alternating Current (*With B. P. Hazeltine*).

Benjamin Prescott Hazeltine (VI), Belfast, Me. Electrolytic Rectification of An Alternating Current (*With L. A. Hawkins*).

Reuben Stewart Henderson, B. S. (I), Olentangy, Ohio. A Discussion of Transition Curves for Railroads.

Bernard Herman (I), Washington, D. C. A Study of the Sewerage Systems of South Framingham, Mass., and Natick, Mass. (*With P. Burgess*).

Frank Edward Hermanns (I), Denver, Colo. A Design for a Three-hinged Arch over the Niagara River.

Joseph Lewis Hern (VI), Dorchester, Mass. Tests of a Rotary Converter (*With W. H. J. O'Leary*).

Henry Harwood Hewitt, A. B. (IV), Chicago, Ill. A Design for a Pantheon.

Benjamin Stearns Hinckley (II), Woburn, Mass. Tests on a 12-Wheel Compound Freight Locomotive of the Boston & Albany Railroad (*With H. A. B. Campbell*).

Everett Hale Hinckley (X), Hyannis, Mass. An Investigation of the Action of Size upon Cotton Yarn and the Function of Sizing Compounds.

Amasa Amidon Holden (IX), Boston, Mass. A Study of the Methods Used in Passing Congressional Appropriation Bills, Illustrated by Legislation of the First Session of the Fifty-fourth Congress (1895–1896).

Alexander Rieman Holliday (I), Indianapolis, Ind. A Design for a Single Track Riveted Railroad Bridge of 200 Feet Span.

Frank James Huse (II), Evanston, Ill. Tests on a Timber Truss.

Jerome Paul Jackson, A. B. (IV), Swampscott, Mass. A Design for a Town Hall and Public Library for a Town of Five Thousand Inhabitants.

Henry Philip James (II and VI), Kendall Green, Mass. 1. A Determination of the Distribution of Steam in a Water Gas Plant (*With L. Addicks*); 2. Tests of a Rotary Converter (*With L. Addicks*).

Hans Peter Jensen (I), Tottenville, N. Y. A Design for a Single Track Pin-connected Railroad Bridge of 200 Feet Span.

Edward Johnson, Jr. (I), Boston, Mass. An Investigation of the Different Methods of Supporting Drawbridges on Turn-tables.

Harry George Johnson (V), Auburndale, Mass. The Preparation of Secondary Butyl Bromide.

Lane Johnson (II), Kansas City, Mo. Installation and Test of a Thirty-six Inch Impulse Water-wheel (*With G. B. Street*).

Harry Montifex Keys (VI), Linden, Md. A Method for making a Quantitative Study of the Magnetic Properties of Soft Iron Cores for Coils (*With F. Tappan*).

Fred Louis Holt Kimball (III), Newton Lower Falls, Mass. The Investigation of an Idaho Gold Ore from the Wood River District (*With C. M. Lewis and L. A. Newell*).

William Abbot Kinsman (II), Salem, Mass. An Investigation of the "True Line of Resistance" in a Masonry Arch (*With F. M. Blake*).

James Gerhard Leiper, Jr. (II), Philadelphia, Pa. An Investigation of the Compression on the Bearing Surface of Riveted Joints (*With G. I. Copp*).

Thomas Frank Lennan (V), Belmont, Mass. An Investigation on the Corrosion of Iron.

Clancey Montana Lewis (III), Ketchum, Idaho. The Investigation of an Idaho Gold Ore from the Wood River District (*With F. L. H. Kimball and L. A. Newell*).

Joseph Elliot Lewis (II), Charlemont, Mass. An Investigation of Superheated Steam.

Allen Loomis (XIII), Jackson, Mich. An Investigation of the Action of Rivets in Transmitting Compression across Rivet Holes.

Ralph White Loud (I), Weymouth, Mass. An Investigation of the Loss of Energy at Branch Connections in Water Mains (*With F. O. Clapp*).

Lee Rosenberg Loveman (VI), Nashville, Tenn. A Plant Test at the Walker Building, 210 Boylston Street, Boston (*With G. M. Richmond*).

Almeron Wallace McCrea, B. S. (IV), St. Paul, Minn. A Design for the Residence of the American Ambassador at Paris.

William Scott Matheson (II), Tatamagouche, N. S. An Ex-

perimental Investigation of the Action of the Pendulum Governor (*With E. A. Packard*).

Carl Spencer Milliken (VII), Malden, Mass. An Investigation of the Histogenesis of the Retina in the Embryo Chick.

Clarence Alfred Moore (X), Arlington, Mass. The Effect of Mercerisation on Different Kinds of Cotton, and of Dyeing Aniline Blacks on Unmercerised and Mercerised Cotton (*With T. C. O'Hearn*).

Carl Leon Morgan (VI), Fitchburg, Mass. A Study of the Instantaneous Candle Power of an Alternating Current Arc by the Stroboscopic Method (*With W. L. Wood, Jr.*).

Harry Solomon Mork (V), Roxbury, Mass. The Analysis and Conditioning of White and Colored Silks.

Benjamin Eames Morse (II), Canton, Mass. Tests on an Air Condenser and Steam Heater (*With H. W. Goldthwaite*).

Harry Leonard Morse (II and VI), West Roxbury, Mass. 1. Some Efficiency Tests on a 20 Horse-power Diesel Motor; 2. An Experimental Determination of the Periodicity of a High Frequency Coil (*With J. A. Walls*).

Stanley Motch (III), Covington, Ky. The Decomposition of Silver Sulphide in Copper and in Iron Pans.

Lester Allan Newell (III), Southbridge, Mass. The Investigation of an Idaho Gold Ore from the Wood River District (*With F. L. H. Kimball and C. M. Lewis*).

William Stark Newell (XIII), Winchester, Mass. Progressive Speed Trials of the Steam Yacht *Kaleda*.

Timothy Cyril O'Hearn (X), North Cambridge, Mass. The Effect of Mercerisation on Different Kinds of Cotton and of Dyeing Aniline Blacks on Unmercerised and Mercerised Cotton (*With C. A. Moore*).

William Henry Joseph O'Leary, A. M. (VI), Richibucto, N. B. Tests of a Rotary Converter (*With J. L. Hern*).

Edwin Augustus Packard (II), Mansfield, Mass. An Experimental Investigation of the Action of the Pendulum Governor (*With W. S. Matheson*).

Charles Barnard Page (XIII), Dorchester, Mass. A Study of Vibrations of the Steamship *City of Lowell*.

Worthington Palmer (IV), Albany, N. Y. A Design for a Casino.

Will Rogers Parker (VI), Portsmouth, N. H. An Investigation of the Positive Crater of an Arc Lamp as an Absolute Standard of Light, and a Comparative Test of Two Hefner-Alteneck Amyl Acetate Lamps.

William Edward Parker (I), Allston, Mass. An Investigation of the Measurement of Base Lines with the Steel Tape.

George Alger Pennock (II), Weston, Mass. A Re-design and Study of an Axial Oil Machine (*With G. H. Perkins*).

George Hawthorne Perkins (II), Salem, Mass. A Re-design and Study of an Axial Oil Machine (*With G. A. Pennock*).

William Clifton Phalen (V), Gloucester, Mass. Some applications of the Friedel-Crafts Reaction.

Earle Bernard Phelps (V), New Brunswick, N. J. On β Phenyl-β-sulpho-propionic Acid and Some of its Reactions.

Edward Everett Pierce (XIII), Malden, Mass. A Collection and Reduction of Data for the Powering of Ships (*With E. P. Trask*).

Ralph Howard Pinkham (I), Greenwood, Mass. An Investigation of the Different Forms of Modern Movable Bridges.

Willard Atherton Price (I), Denver, Colo. An Investigation of the Water Supply of Beverly, Mass., with Reference to the Efficiency of Fire Protection (*With A. E. Blackmer*).

George Heywood Priest (X), Waltham, Mass. Tests on a Gas Plant at Waltham (*With F. R. Swift*).

Juan Real y Gaillard, A. B. (I), Santiago de Cuba. An Investigation of Floating Docks.

Ernest Albrecht Regestein (VI), Jamaica Plain, Mass. The Design and Construction of Three-phase and Phasing Transformers to Illustrate Polyphase Distribution (*With H. M. Cushing*).

Clarence Renshaw (VI), Baltimore, Md. The Design and Construction of an Apparatus for the Study of the Alternating Current Arc (*With N. E. Seavey*).

Albert Aden Reynolds, B. A. (V), North Adams, Mass. A

Study of the Penetration of Dyes in Chrome Leather Tanned by a One-bath Process.

Gerald Martin Richmond (VI), Worcester, Mass. A Plant Test at the Walker Building, 210 Boylston Street, Boston (*With L. R. Loveman*).

Herbert Hugh Riddle (IV), Boston, Mass. A Design for a Memorial Rotunda and Administration Building for a Large College.

Lewis Wetmore Riddle (XIII), Chicago, Ill. A Design for a Car-transport Steamer.

George Hayes Riker (X), Somerville, Mass. A Method for Obtaining a White Discharge on Cotton Dyed with Direct Cotton Dyes.

Samuel Brown Robertson (I), East Milton, Mass. A Design for a Three-lift Gas Holder.

Edwin Francis Samuels (II), Hyde Park, Mass. Experiments in Hardening and Tempering Steel (*With R. M. Vining*).

William Otis Sawtelle (VIII), Boston, Mass. A Study of the Electrical Resistance of Metallic Films.

Haven Sawyer (II), Bangor, Me. An Investigation of the Variation of the Coefficient of Friction between Leather Belting and Cast Iron, at Different Speeds of Slip (*With K. M. Blake*).

Norman Emory Seavey (VI), Dover, N. H. The Design and Construction of an Apparatus for the Study of the Alternating Current Arc (*With C. Renshaw*).

Miles Standish Sherrill (V), Louisville, Ky. The Preparation of Certain Derivatives of β Sulpho-propionic Acid:

Edward Warren Sibley (II), Weston, Mass. Some Fly-wheel Calculations.

Frederick Robert Sites (I), Auburndale, Mass. A Plan for the Abolition of the Grade Crossings on the Boston and Albany Railroad at Newton Centre and Newton Highlands, Mass. (*With C. D. Drew*).

Hervey Judson Skinner (V), Wakefield, Mass. The Action of Formaldehyde on Diazo-compounds.

Charles Alfred Smith (I), North Reading, Mass. An Investiga-

tion of Methods of Sewage Disposal for the Town of Reading, Mass. (*With D. H. Taylor*).

Lawrence Clement Soule (X), Newtonville, Mass. Colored Discharges and Resists on Various Aniline Blacks.

Herbert Harris Starr (I), New London, Conn. A Design of One Support of a Cable Way.

Frederic Baldwin Stearns (IV), Brookline, Mass. A Design for a Terminal Railroad Station on Two Levels.

Philip Stockton, A. B. (I), Boston, Mass. A Design for a Fifty-ton Radial Block-setting Crane.

Jacob Stone, Jr. (IV), Minneapolis, Minn. A Design for a Church for a Small City Parish.

Gerald Basil Street (II), Highland Park, Ill. Installation and Test of a Thirty-six Inch Impulse Water-wheel (*With Lane Johnson*).

Edwin Sutermeister (V), Readville, Mass. A Study of Some Compounds of Tellurium.

Walter Hannen Sutliff (IV), Albany, N. Y. A Design for a State Exposition Building.

Clifford Melville Swan (V), Brookline, Mass. An Investigation on the Dissociation of Sulphuric Acid and Its Salts.

Charles Williston Swift (II), Provincetown, Mass. Tests on Cast Iron T-Beams.

Frank Robinson Swift (X), Wollaston, Mass. Tests on a Gas Plant at Waltham (*With G. H. Priest*).

Frederic Tappan (VI), Boston, Mass. A Method for Making a Quantitative Study of the Magnetic Properties of Soft Iron Cores for Coils (*With H. M. Keys*).

Denzil Hollis Taylor (I), Peterboro, N. H. An Investigation of Methods of Sewage Disposal for the Town of Reading, Mass. (*With C. A. Smith*).

Charles Augustine Torrey, Jr. (V), Boston, Mass. The Velocity of Solution of Solid Substances in Liquid Solutions.

Edgar Pierce Trask (XIII), Peabody, Mass. A Collection and Reduction of Data for the Powering of Ships (*With E. E. Pierce*).

John Lawrence Tufts (V), Roxbury, Mass. An Experimental Investigation of the Correctness of Certain Thermo-dynamical

Equations Pertaining to the Heat of Solution of Dissociated Substances.

Robert Macalister Vining (II), South Weymouth, Mass. Experiments in Hardening and Tempering Steel (*With E. F. Samuels*).

Gardner Tuffs Voorhees (II), Cambridgeport, Mass. An Absorption Refrigerating Machine.

Frederick Creelman Waddell (I), Rockport, Mass. A Design for a Railroad Bridge of 300 Feet Span.

Etheredge Walker (III), Boston, Mass. The Precipitation of Gold, Silver, and Copper from Cyanide Solutions by Means of Zinc (*With J. H. Walton, Jr.*).

Robert Bruce Wallace (XIII), Cleveland, Ohio. A Design for a Lake Freight Steamer (*With W. R. Bean*).

John Abbet Walls (VI), Lewisburg, Pa. An Experimental Determination of the Periodicity of a High Frequency Coil (*With H. L. Morse*).

Edward Philip Walters (V), Providence, R. I. An Investigation of the Electrolytic Deposition of Tellurium and of Some Salts of Tellurous Acid.

William John Walther (I), Chicago, Ill. A Comparison of Plans for the Abolition of Grade Crossings at Readville, Mass.

James Henry Walton, Jr. (V), Newburyport, Mass. The Precipitation of Gold, Silver, and Copper from Cyanide Solutions by Means of Zinc (*With E. Walker*).

Frederick Arthur Watkins (II), Chicago, Ill. Coefficients of Discharge of Nozzles (*With W. T. Cannon*).

Charles Albert Watrous (IV), Des Moines, Iowa. A Design for a County Court House.

Walter Wiley Wells (VI), Sackville, N. B. A Comparison of Various Photometers (*With J. F. Chapman*).

Lewis Rose Whitaker (I), Brighton, Mass. A Design for a Railroad Cantilever Bridge.

Harry Keith White (IV), Brattleboro, Vt. A Design for a Hotel.

William White (V), Taunton, Mass. The Formation and the Properties of Torrefaction Dextrines.

Charles Frederic Wing, Jr. (VI), New Bedford, Mass. An

Investigation of the Carrying Capacity of Copper Wires in Iron Conduits when Carrying Alternating Currents.

Percy Warren Witherell (VI), Roxbury, Mass. An Investigation of a Three Phase Induction Motor.

Willard Lyman Wood, Jr. (VI), Upton, Mass. A Study of the Instantaneous Candle Power of an Alternating Current Arc by the Stroboscopic Method (*With C. L. Morgan*).

John Woodward Woollett (I), Belmont, Colo. A Design for a Railroad Bridge with an Intermediate Horizontal Chord.

CANDIDATES AWARDED THE DEGREE OF BACHELOR OF SCIENCE DURING THE YEAR 1898–99.

Timothy Joseph Driscoll (VI), Boston, Mass. An Investigation of the Positive Crater of an Arc Lamp as an Absolute Standard of Light and a Comparative Test of Two Hefner Alternate Amyl Acetate Lamps.

William Braman King (VI), Dorchester, Mass. An Alternating Current Curve Tracer.

William Marshall Perley (V), Medford, Mass. Best Conditions for Smelting Antimony Skimmings.

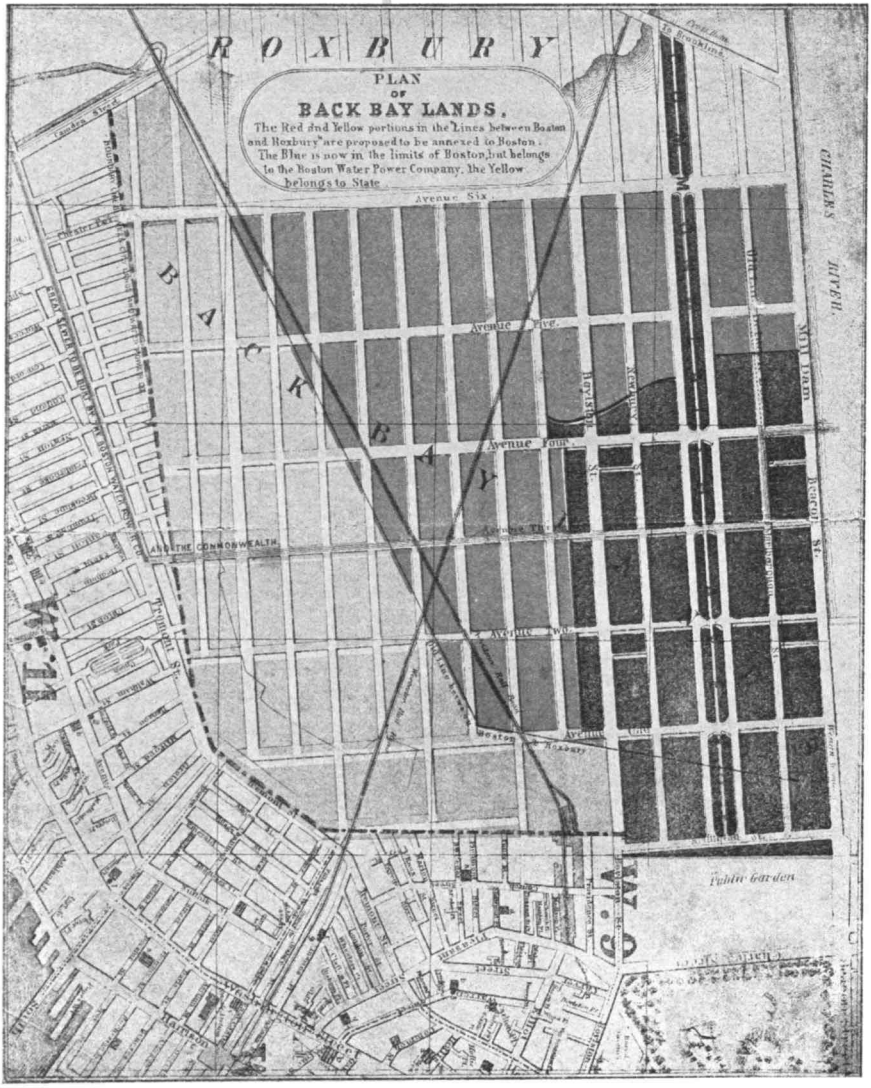
Albert William Tucker (III), Newburyport, Mass. Experiments on a Refractory Gold Ore.

Edward Saxon Wiard (III), Spokane, Wash. Tests on a Richards Separator.

LOWELL SCHOOL OF DESIGN

GRADUATES, 1899

John Herbert Alger, Barton Pike Batchelder, Clara Virginia Baxter, Grace Hammond Davis, Blanche Soper Fernald, Clara Antoinette Howard, Lottie Henson Kidger, George Horace Perkins, Ethel Marion Sargent, Maude May Thuresson, Millie Houghton Tileston, Herbert Lyman Tripp, Beulah Locke Wood, Myra Jeannette Wright.


ROXBURY
PLAN
OF
BACK BAY LANDS.
The Red and Yellow portions in the Lines between Boston and Roxbury are proposed to be annexed to Boston.
The Blue is now in the limits of Boston, but belongs to the Boston Water Power Company. The Yellow belongs to State
BACK BAY
Avenue Six
Avenue Five
Avenue Four
Avenue Two
Avenue One
Charles River
Public Garden

LAND SCRIP FOR SALE.

The subscriber, having been appointed by the Governor and Council, Commissioner to sell the scrip for 324,000 acres of land, granted by the Act of Congress of 1862 to this Commonwealth, for the promotion of Agriculture and the Mechanic Arts, now offers the scrip for ONE HUNDRED THOUSAND ACRES at public sale.

The income of the fund thus to be raised has been devoted by the Legislature to the support of the Agricultural College and the Institute of Technology. It is believed that no safer investment of money can be made, in these unsettled times, than in this scrip. It is no figure of speech now to say, that land is the only *real* estate, — the only property of reliable permanent value. The scrip may be located at once, or it may be held without care, or risk of loss, or the payment of taxes, for location at any future time. Capitalists or companies, by locating these lands in large tracts, in those States where slavery is going out, may find rich rewards for their enterprise by organizing settlements upon them. The erection of a school-house in place of a slave-pen, in any locality, soon doubles the value and price of land.

Citizens interested in the Agricultural College and the Institute of Technology are urged to attend to this matter Every acre of this land ought to be taken by the people of our own Commonwealth, who are its real owners, and whose interests require its immediate sale at a fair price. Fifty cents in gold may buy an acre of excellent land.

Each piece of the scrip is for 160 acres, and entitles the holder to locate upon any Government lands which are open to private entry at $1.25 per acre.

The title is direct from the United States to this Commonwealth, and the scrip by assignment in blank, under the hand and seal of the Commissioner, becomes a simple and sure title, which may be sold and transferred by mere delivery.

That our own citizens may have opportunity to purchase, I offer this scrip for sale to the highest bidder, upon the following conditions: —

1. The bids must be sent by mail or otherwise, to the subscriber, on or before the 23d day of July, 1864, in sealed envelopes, marked "Bids for Land Scrip," with the full name and residence of the party. The bids may be in this form: "I will take pieces of the Land Scrip, 160 acres each, at cents per acre, on the terms advertised." (Signed.)

The bids will be all opened and recorded at one time, in presence of a committee of the Council appointed by the Governor.

2. Bids can only be received for 160 acres, or multiples of that number.

3. One quarter of the price must be paid within ten days after notice of the acceptance of the bid shall be deposited in the post-office, and the balance on delivery of the scrip in twenty days more.

4. No bid of less than eighty cents per acre will be received.

5. Bids by persons or companies of other States must be guaranteed by citizens of this Commonwealth.

HENRY F. FRENCH,

6 and 7 Barristers' Hall, Boston, Mass.

JUNE 23, 1864

Land Scrip Circular

Rooms of the Boston
Board of Trade
April 8th 1862

First meeting of the Government.

During a recess in the meeting of the Institute held April 8th at 11 A.M. in the Rooms of the Boston Board of Trade, the Government held a special session—

The President W. B. Rogers in the Chair, and J. P. Runkle was appointed Secretary pro tem.

In accordance with a vote of the Institute the Government proceeded to the election of three members of the nominating Committee, to act with the four already elected by the Institute, to nominate officers for election at the ~~General~~ annual meeting to be held in May, which resulted in the choice of Messrs J. B. Philbrick, Ralph Huntington & M. D. Rogers.

On Motion of W. Philbrick it was Resolved that the President together with the Chairman of the Committee of Instruction Publication the Museum & Finance Constitute a Committee for the purpose of petitioning the Legislature for an extension for another year of the time in which the Institute shall be required to raise the guaranteed fund of at least One hundred thousand dollars as prescribed in the Act of Incorporation.

The Meeting then adjourned.

First Meeting

REPRINTS — II.

Following out its purpose as stated in the first number (page 59), to issue from time to time fac-similes of early documents relating to the Institute of Technology, THE REVIEW presents, through the courtesy of the officers of the Institute, three documents of peculiar interest. All have a direct bearing upon the establishing of the college, through the wise generosity of the State and Federal governments and the devoted efforts of distinguished citizens of Boston.

The circular offering "Land Scrip for Sale" was issued in obedience to the so-called "Morrill Act" of 1862, appropriating large tracts of government land to the furtherance of instruction in Agriculture and the Mechanic Arts. In most of the States the colleges established under this Act covered both branches of instruction; but in Massachusetts the income received from the sale of these public lands is divided in unequal proportion between the Agricultural College, at Amherst, and the Institute of Technology. The amount yielded from this source to the M. I. T. in 1898 was $13,131.37.

The square bounded by Boylston and Newbury Streets and by "Avenue One" and "Avenue Two," on the "Plan of Back Bay Lands," was the gift, contingent upon no alienation of use, of the Commonwealth to the Massachusetts Institute of Technology and the Boston Society of Natural History, in the proportion of two-thirds and one-third respectively. This "Plan," issued in the early sixties, makes vivid the astonishing growth of this section of Boston in less than forty years.

On page seven of the last-issued catalogue of the Institute the statement is made, under the heading of General

Information, that "the first meeting of the Institute for organization was held April 8, 1862." The REVIEW presents a fac-simile of the rough draft of the report of that epoch-making meeting. Beyond its intrinsic value, this draft has interest because it is partly in the handwriting of Professor (afterwards President) Runkle, and partly in that of President Rogers. Of the three other members of the Corporation mentioned by name in this report, Mr. Philbrick was of great service to the Institute through his prominent connection with public education; Mr. Huntington was, next to Dr. William J. Walker, the largest early benefactor of the college (his generosity having been more than duplicated in the recent bequests of his daughter, Mrs. James); and Mr. Ross was one of those most active in developing the "Back Bay," and in securing the gift of a part of its lands for purposes of education. Mr. Ross did much to interest the merchants and manufacturers of Boston in the project of an Institute of Technology, took an active part in its development, and his suggestion, often made at their annual meetings, that the Alumni Association should have a permanent room or house of its own, has taken form in the Technology Club. The committee authorized at this first meeting, by the vote recorded in President Rogers's handwriting, secured from the Legislature a year's extension of time in which to raise the money essential to the incorporation of the Institute; but that extended time had almost elapsed, the project of an Institute was about to be definitely abandoned, when a gift of $75,000 from Dr. William J. Walker, in July, 1863, saved the charter and made the Massachusetts Institute of Technology possible.

Alfonse N. van Daell, LL. D., professor of modern languages at the Massachusetts Institute of Technology, died March 27, 1899, at Wiesbaden, Germany. He had left Boston but two weeks previous, accompanied by his wife and daughter. The trip was made for the benefit of his health, and his sudden death came as a great shock and surprise to his friends and associates.

Professor van Daell, a native of Belgium, studied at the College of Saint Servais, in Liège, graduating B. A., in 1864. He subsequently pursued his studies at Louvain, passing examinations in philosophy and letters. In 1868 he took the degree Docteur en Droit at the University of Liège; and in the two years following attended lectures in Paris, Bonn, and Berlin. He came to America in 1873, and taught in private schools until 1876. He was then called to the chair of modern languages in Kentucky College, where he remained until 1879, when he moved to Philadelphia, and taught for several years thereafter in private schools. In 1885 he became instructor in Haverford College and lecturer in the University of Pennsylvania, which positions he resigned in 1886, to accept the directorship of modern languages in the Boston High and Latin Schools, from 1886 to 1889. In 1889 he became professor of modern languages at the Massachusetts Institute of Technology, which position he held at his death.

Professor van Daell was widely known for his writings and many text-books which he edited, the titles of some of which follow: "A Monograph of the Study of Modern Languages;" "La Parole Française" (in collaboration with

Dr. L. Sauveur); "Das Deutsche Buch" (in collaboration with J. Schrakamp); "Leander's Träumereien" (edited and annotated); "Heine's Harzreise" (edited and annotated); "Mémoirs du Duc de Saint Simon" (edited and annotated); "An Introduction to the French Language;" "An Introduction to the French Authors;" "Extraits choisis de Paul Bourget;" "La Guerre de l'Independence" (edited and annotated).

Professor van Daell came to America with a large acquaintance with men and things in Europe, and with scholarly tastes and acquirements. He had a fine collection of books relating to French literature, and he was a collector of rare editions, making his library a very pleasant room. He lived on Irving Street, in Cambridge, among a group of professors, with whom he was on intimate terms, and in a house of very pleasant atmosphere. He kept in close touch with the preparatory schools, attending their meetings regularly. He took an active interest in all the details of his professional work, and made his system of teaching assimilate with the rest of the studies of the college. All this made him very valuable to the Institute, and his loss is deeply felt.

Among the Faculty Notes may be found the resolutions which have been adopted by his associates, expressing their sense of the loss they have sustained.

GENERAL INSTITUTE NEWS

The Institute year closed with graduation exercises, succeeding the usual two weeks' period of examinations. The number of graduates is 167, distributed as follows among the courses:

Civil Engineering, 30; Mechanical Engineering, 37; Mining Engineering and Metallurgy, 7; Architecture, 22; Chemistry, 21; Electrical Engineering, 30; Biology, 2; Physics, 2; General Studies, 1; Chemical Engineering, 9; Sanitary Engineering, 1; Naval Architecture, 8. Total, 170, of which three graduated from both Courses II. and VI.

There are also three successful candidates for the degree of Master of Science, — Daniel Wilbert Edgerly, of Cambridge, Gorham Phillips Stevens, of Cambridge, and Charles-Edward Amory Winslow, of Boston, all of the class of '98.

Mr. Edgerly has supplemented his course in chemistry by additional work in engineering, and has presented a thesis on "An Investigation of New Methods for Determining the Atomic Weight of Tellurium."

Mr. Stevens has continued his work in architecture, partly along engineering lines, preparing a thesis on "An Investigation of the Stresses of a Steel-framed Dome and a Design for the Framework."

Mr. Winslow has also continued his previous line of work, his thesis dealing with "Experimental and Statistical Studies on the Influence of Cold upon the Bacillus of Typhoid Fever and its Dissemination, with Special Reference to Ice-supply and the Public Health."

The work of our professional departments is appreciably strengthened by having graduate work of such quality, and the Faculty is now occupied with the consideration of further extension of opportunities for graduate study.

In connection with the annual examinations, it may be noted that first year students have now as a rule but three examinations,

being marked in the rest of their studies on term work; in the second year the number varies for different courses from three to seven, the average being about four; in the third and fourth years still greater inequalities occur, the average being five to six. It will be remembered that in many cases these numbers are subject to increase by reason of condition examinations on first term work.

FACULTY NOTES

The annual meeting of the Faculty was held on Monday, May 1st. The election of officers resulted in the reëlection of Professor Tyler as secretary, and in a number of new committee appointments. The Committee on Choice of Courses is discontinued, its original functions being now covered by the administrative routine. On the other hand, a new committee, consisting of Professors Chandler, Sedgwick, and Niles, has charge of the Henry L. Pierce Building. The Committee on Preparatory Schools is strengthened by the addition of Professors Vogel, Goodwin, and Lodge. The Committee on Advanced Degrees — which now becomes the Committee on Advanced Degrees and Fellowships — will include the President, Professors Cross, Lanza, Swain, Chandler, Sedgwick, and Talbot.

At the same meeting of the Faculty the following resolutions were unanimously adopted in memory of the late Professor van Daell: —

"Professor Alphonse N. van Daell, who has recently been removed by death, has been professor of modern languages at the Massachusetts Institute of Technology since 1889. He had previously been a member of the instructing staff of several colleges, always with marked success. For his work he was fitted by an accurate and wide knowledge, not only of languages but of their literatures, by a sympathetic temperament, and by a painstaking zeal. He won the friendly interest of students by his genial presence, and stimulated them by his enthusiasm. To his colleagues he was known as a man of wide accomplishments, of sterling integrity, and of generous humanity. The members of the Institute

Faculty desire to put upon record their appreciation of his work and of his worth as a man. They regret his loss as an instructor, and feel sincere sorrow to be deprived of the friend and of the man. To the bereaved family they offer their warm sympathy, and place this resolution on the records with a full realization that the true monument of such a man is the record of his character and his life."

It may be added that Professor van Daell's health had been somewhat impaired for a considerable period, that he had already planned to take a year's leave of absence, but that his departure for Europe was hastened by increased ill health, which compelled him to discontinue class work in April.

ENTRANCE EXAMINATIONS

Entrance examinations for 1899 were held June 29th and 30th, with advanced French and German on the following day. Arrangements were also made for outside examinations at the following points:

Belmont, Cal.; Buffalo, N. Y.; Chicago, Ill.; Cincinnati, O.; Cleveland, O.; Denver, Colo.; Detroit, Mich.; Exeter, N. H.; Indianapolis, Ind.; Kansas City, Mo.; Louisville, Ky.; Manlius, N. Y.; New York, N. Y.; Philadelphia, Pa.; Pittsburg, Pa.; Portland, Me.; Pottstown, Pa.; Poughkeepsie, N. Y.; St. Louis, Mo.; St. Paul, Minn.; Springfield, Mass.; Washington, D. C.

At Denver Mr. Parce took charge for the first time, relieving Mr. Shepard, of '87, who has very generously served the Institute for a number of years. Indianapolis, Kansas City, and Manlius, N. Y., are new points, the last having been added at the instance of Mr. W. L. Root, '96, whose connection with St. John's School is followed by a number of applications for entrance examinations. At Louisville, examinations were conducted by Dr. Chase Palmer, who was for the years 1882-83 connected with our Department of Chemistry. The death of Captain Hunt in Pittsburg has led to the transfer of the examinations there to the Shady Side Academy, from which a number of students have come to the Institute in former years.

The total registration, 633, is seventy-eight more than last year, and the largest in the history of the Institute. Of these, 261 are preliminary applicants for admission in 1900. A continually increasing proportion of applicants divide their examinations between two successive years. Entrance examinations are also held in Boston in September.

SUMMER COURSES

Plans for summer instruction at the Institute are increasing in extent from year to year, the following courses being offered for the summer of 1899:

I. Mechanical Drawing and Descriptive Geometry.

II. Mathematics — Analytic Geometry; Solid Geometry.

III. Architecture — (*a*) Shades and Shadows, (*b*) Elementary Design.

IV. Chemistry — (*a*) Analytical Chemistry, (*b*) Organic Analysis, Reactions and Preparations, (*c*) Organic Chemistry, (*d*) Water Analysis and Air Analysis, (*e*) Gas, Oil, and Sugar Analysis, (*f*) Textile Coloring.

V. Biology — (*a*) General Zoölogy, (*b*) Physiology of Digestion and Nutrition, (*c*) General and Industrial Bacteriology.

VI. Physics — (*a*) Mechanics, Light, and Electricity, (*b*) Heat, (*c*) Physical Measurements, (*d*) Electrical Testing.

VII. European History.

VIII. Modern Languages — (*a*) French, (*b*) German.

IX. Mechanism.

X. Shopwork — (*a*) Woodwork, (*b*) Forging, (*c*) Chipping and Filing, (*d*) Machine-tool Work.

XI. Surveying.

XII. Sanitary Science and Practical Sanitation.

PROFESSIONAL SUMMER SCHOOLS

The summer school in Mining Engineering has been held in the vicinity of Pittsburg, Pa., under the direct charge of Professor Richards.

Professor Burton has conducted the summer school of Civil Engineering at Cherryfield, Maine. The number in attendance reached nearly thirty. It was found necessary to change the location from that first contemplated on this account.

CORPORATION NOTES

After the adjustment of certain legal difficulties, the Institute has finally received $340,000, under the will of the late Edward Austin. The original bequest of $400,000 is reduced by $60,000, the amount of the United States legacy tax under the new law.

Arrangements have been made for a new portrait of the late Mr. Cummings by Mr. Frederick P. Vinton, whose former portrait was unfortunately destroyed in the fire of April, 1898.

On the Institute's nomination, Professor Chandler has been reappointed a member of the Municipal Art Commission.

Mr. John E. Hudson, president of the American Bell Telephone Co., has been elected a member of the Corporation.

WALKER MEMORIAL GYMNASIUM

The work of the Memorial Committee has made reasonable progress during the spring, although it is necessarily difficult to make rapid advance with an undertaking of this magnitude among men so busy as are Institute graduates, and particularly their class secretaries. Each member of the central committee of nine has a number of classes assigned to him, each represented by one associate member. In each class the associate member is expected to conduct the actual canvass, securing, if he desires, the coöperation of such a number of canvassers that the work may have a strong personal quality and not be dependent merely on the issue of a wholesale appeal. This form of organization has also caused occasional delay, but will doubtless prove in the end more effective. The first efforts of the committee are directed toward securing twenty subscriptions of one thousand dollars each, and forty of five hundred dollars each, the subscription being contingent in every case on the total number to be reached.

The total receipts of the committee up to the present time are $4,600, the total amount subscribed, including what has been paid, $11,035.60. In view of the fact that no very general canvass has yet been attempted, these results are not deemed unsatisfactory.

THE UNDERGRADUATES

JUNIOR WEEK

The last part of the year is always the busiest at the Institute, and this has been especially true of this season. As is customary, a number of social events, practically all those of importance in the spring term, were held consecutively during a few days in last April and the series designated "Junior Week." The fourth week in April was this year devoted to these entertainments, which began by a reception at the Technology Club on the afternoon of Monday, the twenty-fourth, to the guests of the Junior Promenade. The club-house was prettily decorated, and refreshments were served down-stairs. Mrs. G. F. Swain and Mrs. H. G. Pearson received, and the necessary introductions for the coming evening were much facilitated.

The "Prom" itself was held that evening in Copley Hall, and lasted from nine till two. All the suite of rooms, including the main hall itself, the supper-room, the antechamber, and the two reception-rooms and smoking-room, were tastefully decorated, green being the prevailing color. About fifty couples were present, which did not crowd the floor, and altogether every one enjoyed a very pretty and pleasant dancing-party. The matrons were Mrs. James M. Crafts, Mrs. William T. Sedgwick, Mrs. Davis R. Dewey, Mrs. Henry Whitman, and Mrs. Henry M. Whitney.

On the following evening the musical clubs gave their customary spring Home Concert in Paul Revere Hall, and sustained their previous reputation by scoring a hit. Both the hall and the programmes were lavishly decorated, and musically the concert was very

good, evoking much applause from the large audience. Especially fine was the work of the Glee Club, with some original topical songs on Tech's idiosyncrasies.

Following their precedent of the year before, at the conclusion of the programme the floor was cleared of chairs, and informal dancing till midnight followed, at which Mrs. James M. Crafts, Mrs. Francis H. Williams, Mrs. Edwin C. Miller, Mrs. A. Lawrence Rotch, Mrs. Francis Blake, Mrs. George F. Swain, Mrs. Henry P. Talbot, and Mrs. Dana P. Bartlett were the matrons. This evening proved the most popular of the entertainments.

During the week several less formal gatherings were held, as well as one or two receptions, one of these being given by Die Gesellschaft in honor of President Crafts. Arrangements had also been made by the editors of *The Tech* to hold a reception and tea in their office, but this was not given, owing to the death of Mr. Guy P. Burch, a member of the Board.

THE PRIVATE SECRETARY

The Walker Club Theatricals, given as a benefit to make the first contribution to the Alumni Gymnasium, were given twice, at Boston and at Northampton, with decided success. Through the excellent training of the coach, Miss Kate Ryan, the cast was well prepared and made the play a well-acted, laughable affair from beginning to end. The cast was as follows: Rev. Robert Spaulding, Allan Winter Rowe, '01; Mr. Cattermole, John Timothy Scully, Jr., '01; Douglas Cattermole (his nephew), Harry Leonard Morse, '99; Mr. Marshland, M. F. H., Frederic Elwin Everett, '00; Harry Marshland (his nephew), Robert Frazer, Jr., '00; Mr. Sydney Gibson (tailor of Bond Street), Edward Hatton Davis, '01; Miss Ashford, Newitt J. Neall, '00; Mrs. Stead (Douglas's landlady), Herbert Holmes Howe, '00; Edith Marshland (daughter of Mr. Marshland), Paul Gerhard Ludiger Hilken, '00; Eva Webster (her friend and companion), George H. Meade, '00; John (a servant), Arthur J. Eveland, '01; Knox (a writ server), Willard W. Dow, '01; Gardener (at Mr. Marshland's),

Joseph Porter Draper, '00. All the parts went well, some especially well; and the work of a few, in particular, won for the play higher praise than is ordinarily allowed an amateur performance. The presentation was undoubtedly the best of the Walker Club's series. The scenes of the play showed in Act I. Douglas Cattermole's Chambers, and in Acts II. and III. Mr. Marshland's Country Seat.

Through the attractive advertising of the Walker Club, by its striking posters and even more popular rhyming circulars, the Boston performance in Copley Hall, on April 26th, was attended by a particularly large and appreciative audience. The piece was well staged and well played. The hall had been arranged so that during the scenes the stage could be easily observed, and between the acts delightful music and the attractive souvenir programmes, brightly and tastefully arranged, furnished enjoyment for all present. The patronesses were Mrs. James M. Crafts, Mrs. Harry W. Tyler, Mrs. John T. Bradlee, Mrs. Eliot C. Clarke, Mrs. Charles R. Cross, Mrs. C. S. Dennison, Mrs. Davis R. Dewey, Mrs. Eben S. Draper, Mrs. William Endicott, Jr., Mrs. Desmond Fitz Gerald, Mrs. Charles C. Jackson, Mrs. Thornton K. Lothrop, Mrs. A. Lawrence Lowell, Mrs. E. M. H. Merrill, Mrs. Charles J. Paine, Mrs. Robert S. Peabody, Mrs. Alexander S. Porter, Mrs. William Z. Ripley, Mrs. William Barton Rogers, Mrs. A. Lawrence Rotch, Mrs. William T. Sedgwick, Mrs. C. Howard Walker, Mrs. Francis H. Williams, and Miss Helen Wheeler. The ushers were the following prominent Institute men: Walter Owen Adams, '99, Morgan Barney, '00, Richard Baker Derby, '01, George Crocker Gibbs, '00, Russell Henry Glover, 00, Russell Gilpin, '99, Edward Hosmer Hammond, '99, Herbert Milton McMaster, '00, Walter Louis Rapp, '00, Stanley Collamore Sears, '00, and Lewis Stewart, '00. The evening was one of complete, successful enjoyment.

At Northampton, the play was given in the Academy of Music, on April 29th, and was well attended by students of Smith College and visitors from Amherst. The bright, attractive audience quite filled the theatre, and was indeed enthusiastic. The play was given

better, if anything, than it was in Boston, and the actors found a most cordial reception by the Northampton audience. The name of Technology, heretofore almost unknown, on the social side, in Northampton, now carries with it the idea of energy and success. A few members of the Connecticut Valley Alumni Association were present, mingling with the boys at their hotel — The Norwood — and cheering for Technology from the theatre pit. At the close of the play, a triumphal banquet was held at the hotel by the visitors from the Institute.

The play in both Boston and Northampton was in every way successful. The entire profits which can be turned over to the Alumni Association by the club will be very nearly six hundred dollars, most of which was made at the Boston performance.

The committee of the Walker Club for choosing the play was Prof. Arlo Bates, Joseph Porter Draper, '00, and Edward Hatton Davis, '01. The management was undertaken by Carl F. Gauss, '00, Manager; Joseph Porter Draper, '00, Costumes and Properties; Willard W. Dow, '01, Ticket Manager; and Edward Hatton Davis, '01, Press Manager.

To all connected with the theatricals, whether as workers, players, or spectators, congratulations and acknowledgments are now willingly extended. The contribution is to be far from an inconsiderable one; and the appropriateness of the fact that this gift to the Walker Memorial is extended through the Walker Club gives a most pleasing finish to the whole affair.

THE MINSTREL SHOW

The Athletic Association has recently received a substantial addition to its available funds in the sum of $350, the profits from the minstrel show held in the Hollis Street Theatre, on the afternoon of May 12th, by students of the Institute. The occasion marked the most ambitious venture Technology has yet made on the stage, and, we are happy to record, scored one of the deserved successes of the season in the field of amateur dramatics. The scale on which the performance was carried out is roughly shown

by the statement that the chorus consisted of over a hundred voices, the ballet of forty students, and, in addition to this, during the afternoon the stage was occupied by a detachment of M. I. T. Cadets, the Banjo Club, etc. The whole undergraduate body was represented. A large and fashionable audience filled the house.

The patrons and patronesses were: Hon. Josiah Quincy, Mrs. Roger Wolcott, Mrs. Julia Ward Howe, President and Mrs. James Mason Crafts, Mrs. Louise Chandler Moulton, Prof. John D. Runkle, Mr. and Mrs. Robert Treat Paine, Jr., Prof. and Mrs. Henry P. Talbot, Mr. and Mrs. Arthur Foote, Prof. and Mrs. Charles R. Cross, Mrs. Oliver Ames, Prof. and Mrs. Wm. T. Sedgwick, Mr. and Mrs. J. Montgomery Sears, Mr. and Mrs. W. F. Apthorp, Dr. and Mrs. Morton Prince, Mr. and Mrs. Henry Austin Clapp, Miss Louise Imogen Guiney, Dr. and Mrs. John P. Sutherland, Mr. and Mrs. Frederick P. Vinton, Dr. and Mrs. Samuel J. Mixter, Prof. Arlo Bates, Dr. and Mrs. Quincy A. Shaw, Jr., Mr. and Mrs. C. P. Curtis, Mr. and Mrs. D. W. Cheever, Mr. and Mrs. Samuel Cabot, Miss Kate Sanborn, Mr. F. J. Stimson, Mr. and Mrs. Arthur Thayer, Mr. Amory A. Lawrence, Mr. and Mrs. H. Staples Potter, Mr. and Mrs. W. B. Kehew, Mr. Alfred Hemenway, and Mr. Charles Follen Adams.

The show was made up of three parts, as follows:

PART FIRST

OLIO

Opening Chorus. Arranged by Henry T. Ballou

Song. "Scared Up" . . . . . Arthur Foote
Written expressly for this occasion.
Wallace Poor Davis, '01.

Song. "My Ann Eliza"
Harry Lamar Grant, '00.
Francis B. Driscoll, '01, "My Ann Eliza."

Song. "De Massa ob de Sheepfol'" . . . Arthur W. Thaver
Written expressly for this occasion.
Matthew Chauncey Brush, '01.

Song. "What I Know" . . . Words by Allen W. Jackson
Words and music written expressly for this occasion.
Charles Van Merrick.

Mandolin Solo. "Transcription" . . . . . Siege
Milton Weston Hall, '00.

Song. "Mr. Johnson, don't get gay."
Lewis Emery, '99.

Owl Song. Quartet . . . . Waldron Holmes Rand, Jr.
Written expressly for this occasion.
Harry G. Johnson, '99.
Richard B. Derby, '01. Lewis Emery, '01.
Matthew Chauncey Brush, '01.

Finale. "America Always." Words by Will Stokes, Private, U. S. A.
Music arranged by John Franklin Botume.

PART SECOND

THE DRAMA IN DARKTOWN

Original Comedy Sketch. Written expressly for this occasion

Dramatis Personæ

Uncle 'Rastus Jones		Miles Standish Sherrill, '99
Aunt Milly Jones		Harry Leonard Morse, '99
A. George D. Jones	The Triplets	George Webster Emery, '00
P. McK. Jones		M. S. Richmond, '99
Richmond P. H. Jones		John Russell Morse, '01
Lorinda Lillie Jones		Allan Winter Rowe, '01
Colonel Cooners		Horace Johnson, '01
Andy Aurelius		Mortimer Bristol Foster, '01
Marm Dinah		Albert Voltaire Möler, '00
Lieutenant Whifflerine		Elmer Merrill Hervey, '02
Melinda Mary		Frederick Roy C. Boyd, '01
Sis Sapphira		Paul Raymond Brooks, '00
Darktown Tough Tigers		Detachment of M. I. T. Cadets
Corps de Ballet.		
Darktown Belles, etc.		

The time is the present. The scene is the interior of Uncle 'Rastus's Cabin.

PART THIRD

Banjo Selection. "South Car'lina Sift" . . . . . Tracy

M. I. T. Banjo Club.

Plantation Shuffle

Miles Standish Sherrill, '99.

X-Ray Fantasy

Charles Robert Cross, Jr., '01. Arthur Gunderton Hayden, '01.
William Jason Mixter, '02. Francis Lippitt Cady, '00.
Charles Galloupe Mixter, '02. James Loockermann Taylor, '02.

Grand Ballet

Pas Seul

Lewis Emery, '99.

Pas de Trois

Mortimer Bristol Foster, '01. Allan Winter Rowe, '01.
Anthony Winfred Peters, '01.

The musical numbers were remarkably well rendered, and the work of the chorus was exceptionally good. The jokes by the end men (Ralph Plumb, '01, Interlocutor) were well received. During the second and third parts of the performance many novelties were introduced, one of the most striking being the X-Ray Fantasy or Skeleton Dance. The climax was reached, however, with the entrance of the ballet dancers, each clad in black tights, white slippers, white tulle skirts, and white bodices. The effect was bewildering. The different figures of the ballet were faultlessly executed. The final tableau followed.

The programmes were elaborately gotten up. The covers were in the Tech colors of red and gray, the design being by H. S. Bird, '88. Inside were half-tone cuts, taken from *Technique*, *1900*, of the athletic teams and musical clubs. One page was devoted to an account of what the Institute has done and is doing in athletics and more in detail the records made by our teams in the past season.

Technology Publications. — The past year has been an unusually successful one financially for *The Tech*, and the paper has, after a long struggle, once more succeeded as a business enterprise. The support received from the undergraduate body has been most encouraging, although the number of alumni subscribers is smaller than at other New England colleges publishing weekly papers similar to *The Tech*. It is the hope of increasing still further the circulation of the paper that has led to the reduction of the subscription price for next year from $2.50 to $2.00 for the thirty issues of Vol. XIX. It is also hoped that this price will put the paper within reach of a number of students who felt themselves unable to subscribe at the old price.

Technique, 1900

Technique, 1900, dedicated to the Massachusetts Institute of Technology, made its appearance on Thursday of Junior Week. It is most attractively bound in a combination of black leather and red linen, stamped with the title, a scroll, and the Institute seal in silver. The book is original without differing radically from the *Techniques* of the past three or four years. The feature probably of most interest and value to Tech alumni is a comprehensive history of the Institute from the time it was founded down to the present. The Faculty appear prominently, to their advantage or rather disadvantage, in the department of Grinds. The illustrations are uniformly good. The Board of Editors is Louis Stewart, editor-in-chief; Morgan Barney, Bertram W. B. Greene, associate editors; Walter L. Rapp, society editor; C. M. Leonard, G. O. Schneller, statisticians; Herbert M. MacMaster, athletic editor; Walter C. Dean, Burton S. Clark, art staff; G. H. Belknap, business manager; C. F. Gauss, assistant business manager.

Technique, 1901

Work has already commenced on *Technique*, 1901. The editors have been elected as follows: Editor-in-chief, John Timothy

Scully; associate editors, Edward Hatton Davis, Philip Coombs Pearson; society editor, Warren Ira Bickford; athletic editor, Ray Murray; statistics editors, Newman Loring Danforth, Charles Ward Adams; art editors, Edward Townsend Howes, William Truman Aldrich, Samuel Winthrop St. Clair; business manager, Percy Harry Parrock; assistant business manager, Leonard S. Florsheim.

THE FRESHMAN BATTALION

The Freshman Battalion was handicapped by the loss of two months at the beginning of the year. An innovation was made in the method of appointing officers. Usually this had been done from the results of a written examination held before the first drill. This year, for a few drills, all were privates, squad leaders being volunteers who wished to show their ability. A theoretical examination was then held, and from it and from the preceding personal observation, corporals were appointed. In the same way, as the year progressed, sergeants were secured, and then lieutenants. From these, without examination, the captains were selected and, finally, in April, the major was appointed. The result was very satisfactory.

An effort was next made to stimulate intercompany rivalry in military athletics. This did not meet with the expected success, and was for the time being abandoned. Great success did, however, attend the rifle calisthenic and picked company work, and in these lines exhibitions have evoked great praise and a fine trophy from the army and naval officers who saw them. Several battalion exhibition drills have been held with much credit to the class. Voluntary rifle practice for all students has also been started and much interest aroused. The Corporation made an appropriation for target hire and the government provided the ammunition. Instruction was given to over eighty men, and an interesting team match was shot between the three lower classes. Steps are now being taken to form a rifle association for another year, and to arrange an intercollegiate league for teams.

On the whole, progress has been rapid and satisfactory, and the

battalion is now at such a standard as to be considered very satisfactory by Colonel Weaver, Colonel Russell, Captain Dodd, and the other regular officers who have examined it.

In military science the attempt has been made to keep the instruction practical, and of use to those who may be in future engaged in military work. It has also been constantly borne in mind that, with the great majority of students, the work in this course will be their only contact with the military system of our country. Every effort has been directed toward giving these men knowledge which will in future enable them to act their part as citizens intelligently, in providing suitable laws for our national defence. Though attendance was voluntary, an average of one hundred and seventy-five students have attended the lectures.

J. Bordman, Jr.

ATHLETICS

The annual ball game between the two lower classes occurred on May 13th, and resulted in a victory for 1901 by a score of 6 to 4. It had previously been the custom to hold the game at the South End grounds, but, unfortunately, the Boston baseball club played there on the only day on which the class game could be held, and the management therefore resorted to the Charles River Park.

Both teams played remarkably well, and the fact that the Sophomores won was largely due to H. B. Wood, who struck out sixteen men. 1901 had six members of her victorious Freshman team back: W. G. Sucro, H. B. Wood, H. A. Whiton, C. W. Adams, L. B. Wilder, and L. P. Hounsfield. Bigelow was first substitute last year, while the two new men, W. T. Martin and J. H. Sabin, had both had experience on college nines. Aside from the pitching of Wood, the work of Whiton behind the bat and of Adams between second and third was especially commendable. Sucro, as captain, used good judgment in his handling of the team throughout the entire season.

The Freshman nine fielded quite as well as their rivals with the exception of shortstop and catcher. Their batting was weak and probably lost them

the game. C. A. Sawyer, who had had but little previous experience, was particularly noticeable by the amount of ground he covered at second, and by his squeezing in a two-base hit. Captain Pond, from Williston Academy, pitched a good game, but was touched up a little at the beginning of the game.

The tabulated score:

1901	A.B.	B.	P.O.	A.	E.
Sucro, c. f.	4	0	2	1	0
Adams, s. s.	4	1	3	0	0
Sabin, 1st	3	2	2	0	0
Wood, p.	4	1	0	2	0
Whiton, c.	4	1	17	0	1
Martin, 2d	4	1	1	0	0
Hounsfield, 3d	3	2	2	0	1
Bigelow, r. f.	4	0	0	0	0
Wilder, l. f.	3	2	0	0	1
Total	33	10	27	3	3

1902	A.B.	B.	P.O.	A.	E.
Franklin, c. f.	3	1	2	0	0
Mansfield, s. s.	4	1	2	2	1
Pond, p.	4	0	0	3	0
Place, 3d	4	0	3	0	1
Gannett, c.	3	0	7	2	1
Odell, 1st	4	0	5	0	0
Sawyer, 2d	3	2	7	1	0
Littlefield, r. f.	3	0	0	0	0
Fish, l. f.	3	0	1	1	0
Total	31	4	27	9	3

Innings	1	2	3	4	5	6	7	8	9	
1901	1	3	0	1	0	1	0	0	0	— 6
1902	1	0	1	0	0	0	1	1	0	— 4

Earned runs — 1901. Two-base hits — Sabin, Martin, Wilder. Three-base hits — Hounsfield. Sacrifice hits — Sabin, Gannett. Stolen bases — Mansfield, Sawyer (2), Franklin (3), Wilder, Adams, Bigelow, Martin, Gannett. First base on balls — Adams, Hounsfield, Gannett, Franklin. Struck out — By Wood, 16; by Pond, 5. Double play — Fish to Sawyer. Time — 1 hour and three-quarters. Umpire — Weeden. Attendance — 350.

THE GRADUATES

WASHINGTON SOCIETY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

The first informal dinner of the Washington Society of the Massachusetts Institute of Technology was held on April 29th, at Freund's. The following were present: Beal '71, Wright '72, Rich '84, Newell '85, Cole '87, Gerrish '88, Stetson '88, Deetz '89, Dorman '93, F. E. Matthes '95, G. H. Matthes '95, Bakenhus '96, Pressey '96, Sumner '96, Woodwell '96, Barrows '97, Allyn '98, Proctor '99, and A. E. Adams, thirteen classes being represented by nineteen men. The dinner was presided over by Newell '85, president of the society, assisted by Pressy '96, the vice-president. Each one present was called on for a short speech, and the result was an interesting collection of stories and reminiscences, mostly drawn from Institute life. The evening as a whole was a very pleasant one, and although each one saw many new faces, all parted old friends.

NEWS FROM THE CLASSES

1870.

PROF. CHARLES R. CROSS, *Sec.*
Mass. Inst. Technology, Boston.

S. M. Cary, '70, is the president of the Robinson & Cary Co., dealers in machinery and railway supplies in St. Paul, Minn., having held this position since the incorporation of the company in 1889. The company issues a price-catalogue of five hundred pages, and is the leading firm in its line in that section. The business was established by the firm, Robinson & Cary, in 1871, and has from the beginning held a high reputation for ability and integrity. Regarding his chosen location, Mr. Cary writes as follows: "As for the industrial conditions and prospects of this section of the country, I can but consider myself most fortunate in having stumbled upon this particular locality. This city of St. Paul is the geographical centre of the North American Continent, is the head of navigation of the Mississippi River, and the town, though not large in population, is most beautifully situated, and as a financial and commercial centre is far beyond its statistics of population. As a State, Minnesota would appear to hold an almost unique position. Within its boundaries is, as above stated, the head of navigation, and also the source of the Mississippi River. It is also tributary to the largest lake in the world. Minnesota is, besides, the largest wheat-producing State in this or any other country. It is also the leading producer of Bessemer iron and steel ore, and of dairy products, more notably high grade butter, the State now containing 754 creameries. The quality of these products is due primarily to the fine quality of succulent grasses, the careful education given by our Agricultural College, and the natural thrift and cleanliness of a class of people reared in so salubrious a climate. Aside from this, Minnesota is, if not the largest, a producer of pine and other grades of lumber equal to any State. She also furnishes various other products, cattle, horses, sheep, and hogs, in large quantities. The State contains over five thousand beautiful lakes, has

a most healthful climate, a good quantity of both timbered and prairie country, fine scenery, clear water, and many other desirable advantages. Among the latter may be prominently mentioned its railroad facilities. Probably no finer trains are run than between Minneapolis and St. Paul, and Chicago. About eighteen trains run daily between these points, and in addition to this we have three trans-continental roads starting from here to the Pacific Coast, one over the Canadian Pacific (Soo Line), one over the Great Northern, one over the Northern Pacific, the latter also leading to Yellowstone Park. Either one of these last three mentioned reveals to the traveller the most magnificent mountain scenery in crossing the Rocky Mountains, and all run most beautiful and luxurious trains to the Pacific Coast, the Canadian Pacific reaching the coast at Vancouver, the Great Northern ending at Seattle, and the Northern Pacific ending at either Tacoma or Portland." — J. R. Osgood writes from Los Angeles as follows: "I have never ceased to regret that I was not able to complete my full course at the M. I. T., but my army fever troubled my eyes so that I was obliged to give up study. The two years which I spent there were among the most happy, and certainly the most useful, of my life. The instruction gained in those two years has been of most vital use to me. I first went to Michigan after leaving M. I. T. There I put up a hub factory, inventing successful methods of seasoning, also machines for making carriage work. After four years there a long sickness, because of my army malaria, obliged me to sell out and return to Boston. I got hold of the deadest mechanical duck, a metallic packing for piston rods, etc. After over six years of trial, law suits from infringers, and inventing, I succeeded both financially and mechanically, and the 'United States Metallic Packing' is now in use on nearly all of the steamship and railroad lines of our country. I am not now connected in any way with my old company, which does a large business, and has a fine shop in Philadelphia. I made a sudden move to California in '87. On my way there I studied hard, then and afterwards tak-

ing up land surveying for my business. I did a lot of work until hard times came, and, being offered a good position with our water company here, I have been with this company for ten years, surveying, estimating, etc. I have a lemon ranch, but shall get little from it this year, because of excessive drought of last and this year. I am also connected with some mining claims. . . . Southern California is growing rapidly, but in general a man should have some money to start with on first coming here, for there are many coming here for health, who have little to live on, and naturally seek employment. So there are many seeking work. The fearful dryness of this season and of last has resulted in a great development of our underground water system. You know we depend on irrigation, and our mountains are practically dry now. Opening of oil wells, also of gold and silver mines, is going on rapidly in Southern California. Sugar-beets are a good crop here in our ordinary season. We have two electric power companies that get their power electrically from a source many miles from here in the mountains. Los Angeles is growing rapidly; many come here for health who have money enough to allow them to take life easily."— James B. Russell has been wholly engaged in commercial life since leaving the Institute in 1866, and for the past nineteen years has been connected with the U. S. Cartridge Company, chiefly in a financial capacity.

1877.

RICHARD A. HALE, *Sec.*
Lawrence, Mass.

George Walter Capen was married April 19, 1899, to Miss Almena Blanche Knowlton, at All Souls Universalist Church, East Boston. — Henry D. Hibbard is a member of the firm of Hibbard & Rodman, manganese steel safe manufacturers. An extensive series of tests has been given these safes recently, demonstrating that they are practically burglar proof.

1878.

LINWOOD O. TOWNE, *Sec.*
Haverhill, Mass.

The secretary attended the banquet to Captain Clarke, of the *Oregon*, given by the Society of California Pioneers of New

England. Mr. Towne is a son of a forty-niner, and a member of the Society.

1881.

FRANK E. CAME *Sec.*

17 Place d'Armes Hill, Montreal.

Frank W. Rollins, Governor of the State of New Hampshire, issued the following proclamation, which has aroused great interest and discussion throughout the country: "I hereby appoint Thursday, the thirteenth day of April, Fast Day. This custom was inaugurated at a time when all the people of our State placed their trust in the hands of a Supreme Being, and believed firmly in the efficacy of prayer. A goodly number of our people still hold this belief, I am happy to say, and will assemble, as their ancestors have for generations, to invoke the Deity. The decline of the Christian religion, particularly in our rural communities, is a marked feature of the times, and steps should be taken to remedy it. No matter what our belief may be in religious matters, every good citizen knows that when the restraining influences of religion are withdrawn from a community its decay, moral, mental, and financial, is swift and sure. To me this is one of the strongest evidences of the fundamental truth of Christianity. I suggest that, as far as possible, on Fast Day union meetings be held, made up of all shades of belief, including all who are interested in the welfare of our State, and that in your prayers and other devotions, and in your mutual counsels, you remember and consider the problem of the condition of religion in the rural communities. There are towns where no church-bell sends forth its solemn call from January to January; there are villages where children grow to manhood unchristened; there are communities where the dead are laid away without the benison of the name of the Christ, and where marriages are solemnized only by justices of the peace. This is a matter worthy of your thoughtful consideration, citizens of New Hampshire. It does not augur well for the future. You can afford to devote one day in the year to your fellow men, — to work and thought and prayer for your children and your children's children. Given at the Council

Chamber in Concord, this thirty-first day of March in the year of our Lord one thousand eight hundred and ninety-nine, and of the Independence of the United States of America the one hundred and twenty-third."

1882.

WALTER B. SNOW, *Sec.*
Watertown, Mass.

The present address of Edgar B. Thompson is 390 Oak Street, Chicago, Ill. He is with the Chicago & Northwestern Railroad Co. — Charles D. Jenkins is a member of the American Chemical Society. — "Discussions in Education," recently published, comprising General Walker's addresses and papers relating to education, was edited by James P. Munroe. — Harry G. Manning is a member of the Fitchburg Athletic Club. — One of the directors of the Art Commission of Portland, Ore., is Winslow B. Ayer. — The secretary recently called upon James Deering, treasurer of the Deering Harvester Works, Chicago. Although Mr. Deering spent only his freshman year at Tech, he has always retained an interest in it, and has a number of Institute men on his engineering staff. — Edward R. Adams dates his latest communications from Honolulu, Hawaiian Islands, U. S. A. He has long been an ardent annexationist, and seems to be overjoyed at belonging once more to the mother country. His physical condition should be good, for he is a member of the Pacific Tennis Club, the Honolulu Golf Club, and the Athletic Club. — Harry M. Boon, who was with the class as a special student during its second and third years, is now consulting engineer for the Hawley Down-draft Boiler Company of Chicago. — Harry W. Jones, who is well established at Minneapolis as one of the leading architects of the Northwest, was found by the secretary, on the occasion of a recent call, to have changed but little since their last meeting in 1882. — Frederic M. Noa, whom every one in the class remembers as being with it during its freshman year, subsequently returned, completed the course, and was graduated in '94. He is now instructor in modern languages at Cayuga Lake Military Academy, Aurora, N. Y. The May 4th issue of the New York *Sun* contains a half-column commu-

nication with the heading "Professor Noa on the Georgia Horror," from which the following extracts are taken: "Where is the William Lloyd Garrison who will thunder forth words harsh as truth? Where is the Harriet Beecher Stowe who will rouse the dormant and blunted conscience of a nation that tolerates and even condones a practice as iniquitous as black slavery itself? . . . Lynching and the revival of burning at the stake and of other forms of torture have grown to be such gigantic evils that they must be eradicated, even if the whole United States should be obliged to come under the sway of an enlightened despot like Cromwell." — Harry M. Neff has changed his address to 221 Ayme Block, Denver, Colo. He was officially connected with the work of construction of the reservoirs of the Great Plains Water Storage Company. — A special feature of the last convention of the American Foundrymen's Association at Pittsburg, Penn., was a paper on "A New England Foundry," by Arthur W. Walker. By means of a hundred lantern slides he portrayed the unique character of the new plant of the Walker & Pratt Manufacturing Company at Watertown, Mass. — Charles J. A. Wardwell, a member of the class during its freshman year, is now located at Woonsocket, R. I. — The beautiful Houghton Memorial Chapel, recently dedicated at Wellesley College, was designed by Heins & La Farge, who are famous as the architects of the Cathedral of St. John the Divine in New York City. — "Steamboiler Practice," by Walter B. Snow, has recently been published.

1884.

Prof. A. H. Gill, *Sec.*
Mass. Inst. Technology, Boston.

The annual class meeting was held February 23d, with eleven members present, as follows: Appleton, Bardwell, Bridgman, Coburn, Dearborn, Doane, Puffer, Rotch, Stebbins, Stuart, and the secretary. Letters were read from a number of absent members, although these were fewer than we desired. — Hillyer is president and general manager of the Peninsula Electric Light & Power Co. of Newport News, Va. — Holder writes that he is nearly well after a long and seri-

ous illness. — Colonel Lyle was in Boston the latter part of May, and paid a flying visit to the Institute. — Lull is chemist with the Orono Pulp and Paper Co. at West Great Works, Me. — Ryder is with the Friends' Gymnasium instead of the Drexel Institute. — Williams was married to Miss Mattie S. Wulfjen, April 5th, at Sheridan, Wyo.

1885.

ARTHUR D. LITTLE, *Sec.*
7 Exchange Place, Boston.

The annual class dinner was held on the evening of April 1st, at the Puritan Club. The dinner was one of the largest and most enjoyable held in recent years, twenty-one men being present. The dome of the State House was brilliantly illuminated as the company sat down, and has been lighted up every night since. Among those present were Goodrich and A. C. Fuller. The secretary's report was read, and the president, H. P. Talbot, spoke of the many changes and improvements which have been effected at the Institute during the past year. Morss, representing the Walker Memorial Committee, outlined the plans of the committee for raising the large sum required for a memorial gymnasium. All contributions from '85 should be sent to him. Oakes Ames was unanimously elected president for the ensuing year. — H. P. Talbot is in Europe for the summer, taking a much needed rest. Frederick Fox sailed by the same steamer, June 1st. — Among the novelties shown at the recent electrical exhibition in New York none excited greater interest than the radiophone, by which telephonic messages were transmitted across Madison Square Garden on the beam of a search-light. The ingenious apparatus which made this beautiful result possible was devised by Hammond V. Hayes in the course of a series of experiments directed toward the development of the photophone, invented by Professor Bell, who made the first experiments on the transmission of speech by means of a ray of light. Recently, in experimenting with the receiver employed in this work, it was found that, if an electric arc light was employed as the source of energy, the slight inequalities of the current employed, produced by the com-

mutation of the generator to which the lamp was connected, were distinctly heard. This led to experiments which resulted in a means of superimposing a telephone current upon the current used for the arc lamp. In this way the variations in the current passing through the arc lamp necessarily produce corresponding changes in the heat rays emitted by it, and these changes affect the receiver in such a way as to cause it to emit sounds similar to those employed in the production of the telephone current. The receiver consists simply of a glass bulb or tube containing a small pellet of carbonized fibre. To the opening of the tube is connected an ordinary phonograph ear tube. There would seem to be a possibility overlooked by Shakespeare, that the voice of the telephone girl may yet shine as far as a good deed in this naughty world. — A. D. Little sailed by the *Canada* from Boston, June 14th, on a business trip to London, Paris, and Breslau. — Charles W. Eaton has been for some time engaged in heavy government work at Sabine Pass, Texas, though his address still remains, Care National Dredging Co., Box 361, Mobile, Ala.

1888.

WILLIAM G. SNOW, *Sec.*
4 Post Office Square, Boston.

George E. Claflin is president of the Red Oak Electric Company, Red Oak, Ia. He has just returned from an extended business trip through the South. — Irving T. Guild represented the Boston Architectural Club at the Convention of Architects of the United States and Canada held in June in Cleveland, O. — Arthur S. Williams is secretary and treasurer of the Consolidated Machine Specialty Company, designers and manufacturers of speed-controlling apparatus, etc., 185 Franklin Street, Boston. — James S. Newton is principal partner of J. S. Newton & Co., importers of East India products, 30 Central Street, Boston. — William G. Snow has changed his place of residence to 65 Oxford Road, Newton Centre, Mass. — Charles A. Stone had an exciting experience while on a business trip to the Pacific Coast. The steamer in which he was travelling on Puget Sound was run into and sunk. The passengers

were rescued, but suffered the loss of their baggage.— G. U. G. Holman writes that his lighting company has recently been consolidated with the National Electric Light & Power Company. He attended the National Electric Light Association Convention in New York in May, and met there L. A. Ferguson, Ralph Sweetland, and B. G. Buttolph. — W. H. Blood, Jr., has been in Savannah for several months in charge of work for Stone & Webster. — B. R. T. Collins has been promoted to the position of chief engineer of Station 1, Chicago Edison Company. — L. A. Ferguson is general superintendent of the Commonwealth Electric Company, Chicago.

1889.

FRANK L. PIERCE, *Sec.*
31 Milk Street, Boston.

Twenty-six members of the class accepted the invitation to attend the class dinner March 17th. Twenty-two of the above participated in the celebration. Thirty-six members replied, stating that they would not be present, and letters are being returned daily from the Dead Letter Office addressed to the other members on the list. Francis R. Hart gave some facts regarding his experience in South American railway construction and maintenance, and "Billy" Thurber unloosed considerable enthusiasm regarding the Walker Memorial Fund. Paul R. Hawkins, who served as adjutant of the Second Massachusetts during the "Cuba Libre" campaign, gave a most interesting description of his experience from the time of leaving Camp Dewey, at South Framingham, until the return to Montauk. James W. Cartwright, Jr., was unable to attend, but much of the success of the occasion may be credited to him for the care with which he has preserved the list of "all male students of '89 M. I. T." — Frank E. Sanborn has succeeded Prof. A. L. Williston as director of mechanical engineering at the Ohio State University, Columbus, O. Professor Williston is now located in Brooklyn, at the Pratt Institute. — Arthur L. Davis has recently become the engineer for the Berlin Iron Bridge Company at Berlin, Conn. — At the meeting before the dinner, Franklin Warren Hobbs was elected president and Frank L. Pierce secretary of the class.

1890.

GEORGE L. GILMORE, *Sec.*
Lexington, Mass.

William B. Poland, since resigning his commission on the staff of the chief engineer, 1st Army Corps, at Chickamauga Park, has been with the B. & O. Southwestern Ry. as engineer of construction, with headquarters at Cincinnati, Ohio. — J. R. Hall is now located in Cheyenne, Wyoming. — George A. Packard was married, April 12th, to Miss Edith R. Morrill, of Readfield, Maine. — A. H. Rogers, who has been seriously ill in a hospital in Boston, is recovered and has returned to his mining business in Mexico. — W. H. Johnson, who was class president during the freshman year, is married and in business at Haverhill, Mass. — Frederic E. Kingsbury is teller of the Keene National Bank of Keene, N. H. — H. C. Tuttle, a member of the Knickerbocker Club and a chemist, was a witness in the Adams poisoning case in New York last April. — W. C. Aldrich is instructor in manual training at the Tome Institute, Port Deposit, Md. — Otis Daniell and W. F. Daniell, Jr., are in the paper manufacturing business at Franklin Falls, N. H. — F. P. Gowing is treasurer of the G. A. Gane Shirt Co., 72 Bedford St., Boston, Mass. — F. E. Harnden is superintendent of blast furnaces for the Colorado Fuel and Iron Company, Pueblo, Colo. — L. M. Hills is a manufacturer of straw goods at Amherst, Mass. — R. H. Kimball is a very successful photographer at Concord, N. H., and will always be ready to produce a likeness of any of the rising generation of the Class of '90. — E. M. A. Machado is an architect, with residence at Salem, Mass. — Henry Mesier is curate of St. John's Church at Far Rockaway, N. Y. — S. A. Moss is in the actuary department of the National Life Insurance Company of Montpelier, Vermont. — C. R. Nason is in the actuary department of the Ætna Life Insurance Company of Hartford, Conn. — C. W. Rice is a member of the Technical and Advisory Committee of the National Electric Light Ass'n Exhibition to be opened in New York, May 8th. — Frederick Metcalf is treasurer of the Chase Machine Company, Cleveland, Ohio. — Schuyler Hazard, president of the En-

gineers' Club of Cincinnati, is of the firm of Lee & Hazard, 209 Race St., Cincinnati, Ohio. — Franklin Knight has returned from Colorado and is now curate of St. Stephen's Episcopal Church at Lynn, Mass. — A. H. Newell is running a ranch of 1,800 acres at Forest Lake, Colo., with three hundred head of cattle, seventy horses working, and two 50-H. P. traction engines. — A few members of '90 met informally at the Technology Club on Thursday evening, May 11th, and there placed a memorial picture to our late classmate, Edward Dexter Brown, the only Technology man whose life was lost in the late war with Spain. — Calvin W. Rice delivered a lecture illustrated by stereopticon on "The Development of High Tension Service" at the twenty-second convention of the National Electric Light Association, held in New York, May 24th. — Samuel Douglas Flood, of Chicago, was married on June 1st to Edna Medora Boal. — Gardner T. Voorhees, who was with our class during our four years at the Institute, but did not then receive a degree, has just passed the necessary examinations and has been awarded his degree by the Faculty as a graduate of the Class of '90.

1891.

HENRY A. FISKE, *Sec.*
93 Water Street, Boston.

The Eighth Annual Reunion of the Class of '91 was held at the Thorndike Hotel, Boston, Mass., April 15, 1899. As usual, the attendance was good; there being twenty-six members present, as follows: Messrs. J. Campbell, Goodwin, Alley, Forbes, Bryden, Knowles, Garrison, Wood, Dana, A. W. Pierce, Palmer, Tappan, Hatch, H. I. Cole, H. C. Bradley, W. P. Bryant, Blanchard, Bird, Dart, Bunker, Bowen, Wilder, Hammond, Young, Aiken, Fiske. In the absence of President Cunningham, who was unable to attend as he is just recovering from a severe illness, Secretary Fiske presided. The sumptuous repast was well received and accepted without a dissenting vote. Then came a short business meeting, at which some of those members who had passed the dinner examination with highest honors were barely able to get an L. The salary figures were taken and the

average found to be $2,154 as against $2,124 of the year previous. Several letters were read from members who were unable to be present and they proved a most pleasant feature. Miss Ethel Blackwell writes that, far from forgetting either Tech or the Class of '91, she has most pleasant memories of her four years at the Institute, and she sends the class a most cordial greeting. She has travelled considerably since leaving, and is now teaching at the Woman's Medical College of New York. A very interesting letter from James Swan, at Newport News, Va., tells how much he misses Boston and the boys. He has been one of the regular attendants at our reunions, and would have been with us this year but for the impossible. He says he has a good position with the Newport News Shipbuilding Company, and likes the work. They are very busy and are building among other vessels two 12,000-ton steamers for the Pacific Mail Company. George K. Hooper writes from Chicago that he is thoroughly mixed up in Chicago hustle and finds it as a whole fascinating, although it takes some time to get used to it. He is in the agricultural machinery business for the Deering Harvester Company, one of the largest concerns of its kind in the world, employing 7,000 hands, covering about 87 acres of ground, and turning out about 875 complete machines a day. As there are also several other concerns doing similar work, one can see how great a part the farmer plays in the development of this country. Fred A. Cole writes from Kodak Park, New York, that he wanted very much to attend the dinner, but was unable to bring it about. He is another who looks longingly toward Boston and wonders why he was foolish enough to leave. There are several Tech men at the Kodak works, and three of them have a flat together and enjoy life as much as possible under the circumstances. After reading the letters, Charles F. Hammond, of Detroit, gave a most interesting account of his experiences during the Spanish War. He was master-at-arms on the *Yosemite*, auxiliary cruiser, and, although not seeing much of actual warfare, had many "scares" while prowling around in close proximity to the Span-

iards in the Gulf. The minor happenings on a trip of this kind are unique and inside life on a war-vessel is something we seldom have a chance to know anything about. He told many good stories connected with discipline aboard ship, and it was all most novel and instructive and formed one of the pleasantest features of the evening. The entertainment concluded with a series of lantern slides of the Institute buildings, interiors, laboratories, etc. The pictures were excellent in themselves and were well shown by a professional. Many of the men knew little or nothing of the many recent changes at Tech and the slides were all the more interesting on that account. Gorham Dana furnished a number of pictures of the Valley of the Yosemite, and gave a delightful description of this locality, one of nature's grandest wonders. Some cloud and water effects were shown by the operator, together with war-ships and a picture of the *Maine* as she now lies in Havana Harbor. The evening passed off all too quickly, and the only regret seemed to be that there was not more time for the men to see each other. — Our esteemed classmate, George H. K. Oxford, passed on, from his home in Cambridge, May 2, 1899. A brief account of his life and work will be found elsewhere. W. T. Palmer attended the funeral and flowers were sent from the class. — G. W. Bryden has gone with the New England Structural Company, of which W. B. Douglass, '91, is chief engineer and general manager. — S. W. Wilder has been appointed assistant treasurer of the Merrimac Chemical Company, with office in Boston. He was formerly chemical engineer for the Fall Mountain Paper Company, Bellows Falls, Vermont. — R. D. Cushing, who has been connected with the Fitchburg Railroad for several years and lately with the Boston Elevated Railway Co., has just left for Minneapolis, where he will enter the real estate business with his brother, Luther Cushing.

1892.

PROF. SEVERANCE BURRAGE, *Sec.*
Purdue University, Lafayette, Indiana.

The secretary is now arranging for a class directory, to be published not later than Jan-

uary 1, 1900. Notices are being sent to members of the class, as far as addresses are known. These, however, are confined almost entirely to graduates, and any information concerning any one who was at all connected with '92 will be gratefully received. Such information should be sent to the secretary, Severance Burrage, Purdue University, Lafayette, Indiana.— Frank Edson Perkins, who has been assistant professor of architecture in the University of Pennsylvania, and is now practising architecture in New York, was awarded an Honorable Mention at the Paris Salon of 1899.— William H. Messenger served as assistant engineer in the U. S. Navy, from May 14, 1898, to January 10, 1899.— Arthur J. Ober has been in the U. S. Engineer's Office at Newport, R. I., since 1897, and was in charge of the construction of the rapid-fire battery at Fort Greble, R. I.

1893.

FREDERIC H. FAY, *Sec.*
60 City Hall, Boston.

Notwithstanding the inclement weather, twenty-two members of '93 attended the sixth annual dinner of the class at the Technology Club, Saturday evening, March 18th. This year marked a departure from the custom of holding the dinner at Parker's, by coming to the home of the Institute's social life for the annual gathering; and the Club is to be congratulated upon the excellent manner in which the wants and expectations of the class were met. At the business meeting these officers were elected for the year ensuing: president, William Brewster Page; first vice-president, William Wyman Crosby; second vice-president, Grosvenor Tarbell Blood; secretary-treasurer, Frederic Harold Fay; assistant secretary, Charles Milton Spofford. A committee, consisting of L. W. Pickert, A. L. Kendall, and the secretary, was appointed to solicit contributions for a gift from the class to the Technology Club. A proposition, suggested by Mr. Kato, of Japan, to Mr. Taintor, to collect in a class album the photographs of the members of the class taken in 1893, was discussed; and, while no formal action was taken by the meeting, it was thought that such a collection, if made, might be kept at the Technology Club,

and prove of considerable interest to the class in future years. The announcement was made of the death of one member since the last meeting, Herbert W. Stanwood, who died at the Boston City Hospital, March 9, 1899. Resolutions upon his death have been prepared for the class by T. H. Skinner and the secretary as follows: "In the passing away of our long-known friend and cherished classmate, Herbert W. Stanwood, the members of the class of '93 have suffered a great loss. We take this occasion to express our personal grief and to extend our deep sympathy to his bereaved family." Following the dinner the class was entertained for an hour by Charles W. Taintor, who gave a most interesting account of his travels in Egypt. Mr. Spofford, who is an instructor in the Civil Engineering Department, spoke of the changes and happenings at the Institute during the year, illustrating his talk by lantern slides. Brief remarks by other members concluded one of the pleasantest meetings in '93's history. — An electric railway in Corea has recently been completed by our classmate, Heiichiro Maki, who bears the distinction of having built the first electric road in Japan. At present Mr. Maki is building the Hoshu Electric Railroad in the latter country. Another classmate, G. E. Kato, Chief Engineer of the Municipal Electric Works of Kioto, Japan, writes that the demand for electric power in his section is increasing in geometrical ratio. By these two men '93 is ably represented in the great industrial revolution which is rapidly placing Japan among the leading nations of the world. — During the late war, '93 was represented in the Navy by Frederic W. Baker, who is serving on the U. S. S. *Monterey* as assistant engineer. At present writing the *Monterey* is doing duty with the Asiatic squadron at Manila. — B. M. Mitchell, of Passaic, N. J., who is at present in South Africa on business, left this country in August of last year, and, after a short trip through England and France, sailed from Southampton for Africa, where he is making his headquarters at Johannesburg. From this place he has travelled extensively in that section, visiting Durham, East

London, Port Elizabeth, Cape Town, and the famous Kimberly diamond mines. In his letters home he describes some of the South African methods of transportation. The railway accommodations there are, doubtless, about equal to those in this country of fifty years ago. The small cars are equipped with upright, stiff-backed seats, in which the passenger rides both night and day at a speed quite unlike that of the "Empire State Express." On one occasion, in an uncovered wagon, he made a three-day trip across a desert where the thermometer stood at 114 degrees in the shade. The delights of such a journey are enhanced if one chances to meet a "dust storm," which is probably the most uncomfortable thing to be found in that region. However, in striking contrast to the discomforts of the country is the warm hospitality of its people, who exert themselves to the utmost to make one feel at home. Mr. Mitchell is mechanical engineer for the Manhattan Rubber Manufacturing Co. and resident director (for New Jersey) of the New York Lubricating Oil Co., in both of whose interests this trip is made. Some of the organizations of which Mr. Mitchell is a member are the American Society of Mechanical Engineers, the Engineers' Club of New York, and the Society of Mechanical Engineers, and "The Club" of Johannesburg, South Africa. Mr. Mitchell will return to America in October of this year.

1894.

WALTER E. PIPER, *Sec.*
Fells, Mass.

An informal meeting of the class was held at the Technology Club on April 25th. Notices were previously sent to all '94 men in Boston and vicinity. Eight appeared, — Hawes, Sherman, Phelan, Gilkey, MacClure, Reed, and Piper. After a pleasant dinner, it was voted to adjourn to Keith's Theatre. These informal meetings will be resumed in the fall, when it is hoped every '94 man who is in Boston will be present. — R. B. Price was in Boston recently. He finds Illinois a very busy place, but still thinks New England is good enough to live in.

1895.

EDWARD H. HUXLEY, *Sec.*
29 Hampshire Street, Cambridgeport, Mass.

Azel Ames, Jr., has a good position with the New York Central Railroad. Mr. Ames was with the army in Cuba, and tells many interesting stories of his experiences there. — F. W. Belknap has recently taken a position with the Department of Taxes in New York City. He was with the Nicaragua Canal Commission for some time. — Hermann Kotzschmar was in Boston recently when the U. S. Revenue Cutter *Manning* was being repaired at the Charlestown Navy Yard. Mr. Kotzschmar intends to remain in the service permanently. — It is with regret that the secretary announces the death of G. F. C. Merriss. A short sketch of Mr. Merriss's life will appear in the next number. — A. L. Canfield has given up his position with the Boston Blower Co., and accepted a responsible position with a Chicago firm. — G. R. Howarth was married in February. Mr. Howarth has a good position with the Baldwin Locomotive Works in Philadelphia. — C. F. Tillinghast has recently resumed his position with the Granger Foundry & Machine Co. of Providence. Mr. Tillinghast was with the army during the war. — L. K. Rourke writes interestingly from Panama, where he is at work on the Panama Railroad. — T. B. Booth, VI., has recently been appointed fourth assistant examiner in the U. S. Patent Office.

1897.

JOHN A. COLLINS, JR., *Sec.*
55 Jackson Street, Lawrence, Mass.

Albert Thompson Drew was married on April 5th to Miss Jennie Adams, of Newburyport, Mass. Mr. Drew is with Farbenfabriken Company of Elberfeld, Germany, whose headquarters are in New York. We understand that they have opened an agency in Atlanta, Ga., and that Mr. Drew is in charge there. — Sheldon L. Howard was second lieutenant, Fifth Regiment, Massachusetts Volunteers, until the mustering out; he is now with the Atlas Tack Company of Taunton. — H. F. Sawtelle is with the Cambridge and Boston Bridge Commission. This commission is to build the new West Boston

Bridge. — Albert E. Kimberly, until recently at the Lawrence Experiment Station, Massachusetts State Board of Health, is now with Farbenfabriken Company, New York. — Charles H. Eames is superintendent of the Light, Heat, and Power Company in Lowell. — The secretary wishes to remind some of the men that they have not as yet replied to the circular letter of last November. Also, in case any man changes his place of business, or his address, the secretary wishes to be notified of such change. — The engagement of Irénée du Pont to Miss Irene du Pont is announced. — Arthur T. Hopkins, editor of this REVIEW, has resigned his position as assistant to Doctor Tyler at the Institute to become superintendent of the Boston Almshouse and Hospital at Long Island. Mr. Hopkins was at one time private secretary to President Baker of the Boston Fruit Co., at Port Antonio, Jamaica. — Walter Humphreys has been appointed successor to Mr. Hopkins.

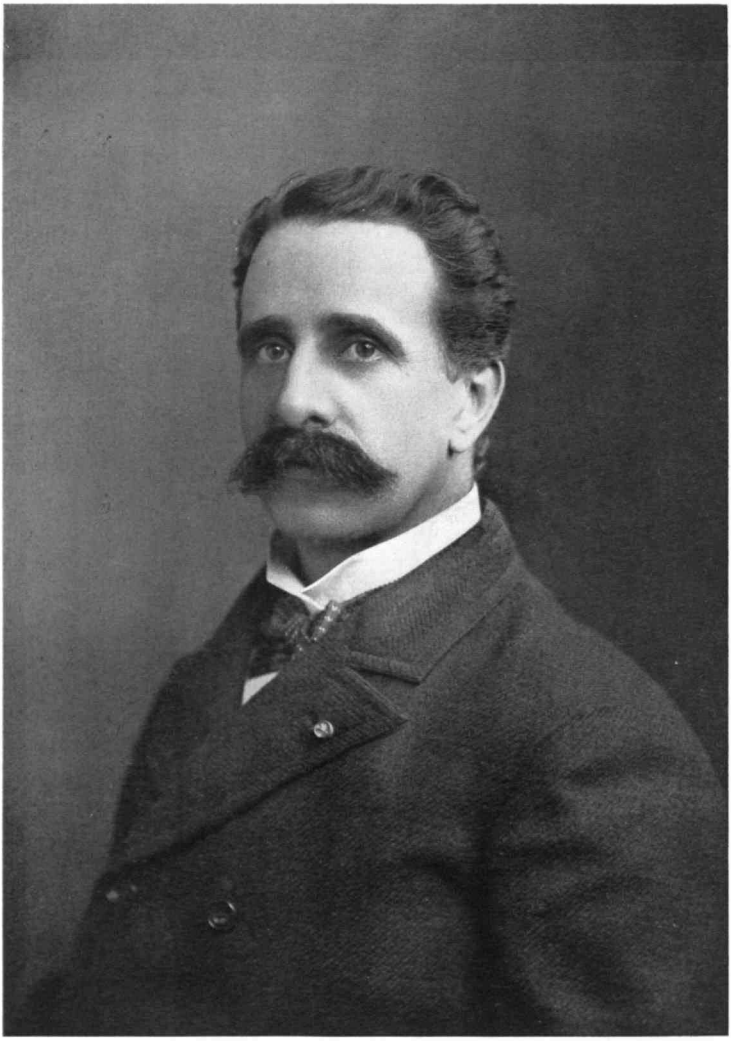
1898.

C.-E. A. WINSLOW, *Sec.*
Hotel Oxford, Boston.

The following canvassers will aid the Walker Memorial Gymnasium Committee in raising funds in '98: Allyn, Brewster, Chapin, Coburn, Danforth, Edgerly, Miss Forest, Gardner, Kaufman, Keene, Koch, Riley, Russ, Russell, Sherman, Waterson. — E. S. Chapin is now with the New York and Boston Dyewood Company, and is in good health again after some months of illness. — L. D. Gardner is with the C. J. Billson Advertising Agency, which represents ten of the most important newspapers of the country, in Chicago. He dictates his letters to his friends now. — P. H. Dater, who was employed on the construction of the new water filters at Albany, is now an assistant in the City Engineer's office at Greenwich, Conn. — F. H. Jones spends the summer abroad. — H. W. Jones has completed his first two years at the Harvard Medical School. — L. D. Peavy is now with Foster & Greene, architectural engineers, New York. — A. W. Tucker has gone to Gold Hill, N. C., in the employ of the Union Copper Mining Company. — Miss Usher is teaching at the Pratt Institute, Brooklyn, N. Y. — C. S. Hurter has returned from

Costa Rica, where he spent the winter with a mining company. A letter he wrote from San Ramon to the secretary before his departure was, in part, as follows: "I have been in this country now about a month. The climate up here in the mountains is about as fine as one can wish for. This place is about 4,000 feet above sea level and the temperature never goes above 75° or below 70°. The same is true of San José, my headquarters. San José has the finest opera house in the Western Hemisphere. Keith's Theatre does not any more compare with it than the Grand Dime compares with Keith's. It cost $3,000,000 gold, which was raised by an export duty on coffee. It is also subsidized by the government so that the best seats are $2.00 in their money, which is equal to sixty cents in the United States. The opera companies are all first class. There are also several fine military bands in San José. I have done a great deal of travelling since I came here. It is all done on horseback. The hills are something terrific. In one case I ascended 5,000 feet in two miles. I have been over on the Pacific side mostly. I have been all over the Gulf of Nicoya. . . . We have just got news of the latest revolution in Nicaragua. There was a four-hour battle, in which two persons were killed. An insurgent was bitten by a snake and a government soldier fell over a precipice. We had a rousing dinner Christmas Eve for the Americans here. Christmas is celebrated here after the fashion of the 4th of July at home. . . . I will send you the money for the REVIEW and the *Class Assessment*. Will you please see that I get January number?" — J. R. Allen is studying architecture in New York. — R. W. Babson has an office in Wall Street, where his specialty is Massachusetts Street Railway Bonds. — J. S. Barber, of Canton, is in the U. S. Geological Survey at Washington. — F. L. Bishop is an instructor in physics at the Bradley Polytechnic Institute, Peoria, Ill. — D. C. Campbell has been sent out to the Pacific coast by the Rand Drill Company, which he represents. — H. L. Coburn is at present with the Electrical Machine Company in Boston. — D. H. Blossom and G. W. Craven have both

found openings in Salt Lake City. — H. L. Currier is with the Cramps Shipbuilding Company in Philadelphia. — A. L. Davis has been acting as foreman in the American Steel Casting Company's works at Sharon, Penn. — J. B. Dixon is at Glens Falls, N. Y., as chemist with the Glens Falls Portland Cement Company. — J. W. Dodd has a position as electrician with the Brookline Gas Light Company. — C. H. Godbold is draughting with the Union Iron Works Company at San Francisco. — C. Goldsmith has been superintendent of the water works at North Andover, Mass. — H. C. Ingalls and J. H. House, Jr., are with Carrière & Hastings, architects, New York. — F. R. Mining is at Reading, Penn., in the employ of the Philadelphia and Reading Railway. — R. Mommers is in the general laboratories of the Glucose Sugar Refining Company, Chicago. — Half a dozen of the Chicago men from '97 and '98 lunch together once a week and sing, " Here's to our old M. I. T." — Perry and Philbrick are separated by all the miles that lie between Pawtucket and Laconia. — H. T. Smith is with the Farist Steel Company, Bridgeport, Conn., as chemist on the group of the " Acids." — Harrington Barker, II., has recently been appointed Fourth Assistant Examiner in the U. S. Patent Office. — R. S. Allyn has graduated in law from the National University, Washington, D. C.



1876

ALFRED EPHRAIM HUNT, of Pittsburg, Pa., one of the most widely known and best loved sons of our Alma Mater, died suddenly at the Hotel Lafayette, Philadelphia, Pa., on Wednesday, April 26, 1899, from a complication of cardiac and enteric disorders, resulting from exposure at Chickamauga and Porto Rico during the Spanish War.

He was born in East Douglass, Mass., March 31, 1855, and was thus but forty-four years old. His father was Leander B. Hunt, of East Douglass. His paternal grandfather established the Hunt Axe and Edge Tool Works at East Douglass, another ancestor served with distinction in the Revolution, and it would thus appear that his fondness for metallurgical and military matters was inherited. He was descended in the eighth generation from William Hunt, who, in 1635, came from Salisbury, England, and was one of the original settlers of Concord, Mass. His mother is Mrs. Mary H. Hunt, of Dorchester, Mass., well known from Maine to California for her devotion to the cause of temperance education. He was married, in 1878, to Maria T. McQuesten, of Nashua, N. H., who, with one son, Roy Arthur, now seventeen years of age, survives him.

Captain Hunt was prominent in the membership of various technical societies; he had been president of the Engineers' Society of Western Pennsylvania; vice-president of the American Institute of Mining Engineers, and was a member both of the American Society of Mechanical Engineers and of the American Society of Civil Engineers. In 1893 he received from the last named society the Norman gold medal for his paper on methods of testing structural steel. He was also a member of the British Iron and Steel Institute and of the Institution of Civil Engineers of Great Britain.

He took an active part in the promotion of good government in Pittsburg, was influential in starting the movement for purification of its public water-supply, and at the time of his death was asso-

ciated with the eminent scientist, John A. Brashear, on a commission appointed by the city to investigate remedies for the smoke nuisance. He was urged by prominent men of both parties, on his return from Porto Rico, to accept the nomination for Mayor of Pittsburg, but declined, feeling that, with the pressure of his private business, his health would not stand the strain.

He was, in all ways, the most thoroughly alive man the writer has ever known. Quick to see the signs of renewed commercial activity, on returning from the war he at once began upon enlargements of the already extensive works of The Pittsburg Reduction Company, doubling the capacity of their rolling mill near Pittsburg and of their electric smelting works at Niagara; he was planning also the development of new bauxite mines in Arkansas, and worked without ceasing, almost until he dropped. He realized that his strength was impaired, and arranged to take a few days' recreation with his wife and mother, and had started for Atlantic City, when, stopping for a few days in Philadelphia, he was taken seriously ill, rapidly became worse, and passed away before the friends who had witnessed his constant activity had realized that he was not a well man.

In his student days at the Institute of Technology, he became warmly interested in the course in military science and tactics given by Lieutenant (now Captain) E. L. Zalinski, Fifth Artillery, U. S. A., and was given command of one of the companies in the Institute Battalion. Before graduation, he had enlisted in the Ninth Massachusetts, and rose rapidly from private to corporal, sergeant, lieutenant, and captain. He resigned on removal from Boston to Nashua, but soon enlisted in the New Hampshire Militia, was appointed first sergeant, six months later was made lieutenant, and a month later, captain, resigning on moving to Pittsburg in 1881.

About fifteen years ago, he organized in Pittsburg, Battery B, enrolling first as a private and soon being elected captain. Under his captaincy, this quickly became one of the best military organizations in the State. In the effort to bring the discipline of his battery to the highest standard, he visited, as opportunity offered

in the course of business travel, the militia of other States, and repeatedly attended battery drill of the U. S. Regulars and inspected the English military evolutions at Aldershot. In forming this battery an unusually excellent grade of men was recruited; the drivers were many of them young, active teamsters, thoroughly familiar with the care and training of horses; the gunners and men who manned the Gatlings were recruited largely from the good mechanics in which Pittsburg abounds. The battery had recently been equipped with modern steel guns, and when mustered into the national service it had among the U. S. Volunteers no superior in equipment, discipline, or personnel.

Within twenty-four hours of President McKinley's call for troops, its members had met, and every man, without a single exception, voted "Yes." The battery was thus the earliest to volunteer for the Spanish War. Captain Hunt himself had large business interests which, owing to the long commercial depression, were just at that time in a critical condition, and imperatively demanded his personal care, but his patriotism was instant and supreme.

Himself a skilled chemist and sanitary expert, he sought unremittingly from the first day of camp life to inculcate, encourage, and command complete obedience to sanitary precautions. Although himself worn out and invalided home from Chickamauga, and again overcome with malarial fever in Porto Rico, he had the deep satisfaction of bringing back with him to Pittsburg every man that he led away.

The peculiar resources of this command, with an experienced engineer in charge, and a corps of trained and skilful bridge erecters in the ranks, were found useful at the landing at Arroyo, where they promptly constructed a long pier on which the guns were taken ashore, and at a deep ravine on the line of march across Porto Rico, through whose waters the skilful teamsters of Hunt's Battery were the first to lead the way. A day later, Hunt, his bridge crew supervising and with many willing hands assisting, constructed in about eight hours' time a crude bridge over this ravine, strong enough to withstand a troop of cavalry at full gallop,

and over which the remainder of the army train crossed with comfort and ease. At the request of the editors of *The Tech*, he presented a brief outline sketch of some of these experiences, in the issue of March 2, 1899.

At the close of the war the members of this battery were actors in a very dramatic incident, described in the first number of THE REVIEW. The Spaniards were disputing the way of General Brooke's division; the Mauser bullets were already whistling; this battery had the head of the line, and was drawn up for action with guns loaded and with the intention of opening fire immediately in what promised to be a very active engagement, when a messenger, hastening forward, handed General Brooke a cablegram, annnouncing the protocol and cessation of hostilities. *Harper's Weekly* published a lifelike illustration of this scene. Captain Hunt's likeness does not appear in this picture, because of the fact that the artist was some miles in the rear when the event occurred, and when the battery, at the request of the artist, posed for its photograph some days later, the captain was flat on his back with malarial fever. He was in fact standing at the side of General Brooke, and in front of his battery, when the cablegram was received.

Captain Hunt will be long remembered as the leading personality in the development of the aluminum industry, but his whole professional life had been active, broad, and useful to an unusual degree. He was graduated with the class of 1876. During the latter part of his senior year he busied himself during the afternoons with analytical and metallurgical work for the Bay State Steel Company of South Boston, and continued with them for some time afterward, assisting in the erection of the second open hearth steel plant in the United States.

Soon after graduation, at the suggestion of the manager of these works, he was sent West, to investigate some newly discovered ore deposits in northern Michigan, and his favorable reports had an important bearing on the development of mines which are a part of those now forming the most active and profitable iron mines of the world.

In 1877 he went to the Nashua Steel Company, as metallurgist, and continued there in charge of chemical and metallurgical work for their open hearth department until 1881, when he resigned to become metallurgical chemist and superintendent of the heavy hammer department for Park Brothers & Co.'s Black Diamond Steel Works at Pittsburg, Pa.

In 1883 he resigned, and associating himself with Mr. George H. Clapp, who had also been trained in the Park Brothers' Works, established a chemical and metallurgical laboratory, acted as consulting metallurgists for many of the mills about Pittsburg, and did the chemical work for the Pittsburg Testing Laboratory, established in the same year by William Kent and W. F. Zimmermann; Hunt and Clapp later bought the complete control of the Pittsburg Testing Laboratory and greatly enlarged its field of work. This Testing Laboratory may be regarded as the pioneer establishment of its class. Under Captain Hunt's earnest and aggressive management the business became highly prosperous, a corps of fifty or more chemists, metallurgists, inspectors, and assistant engineers being at times employed. Notwithstanding the demands of business on his time and vitality, Hunt always retained the most lively interest in Technology affairs, found openings for many Technology graduates, extended warm hospitality to any Tech man that he found in Pittsburg, and for years conducted the local examinations at Pittsburg for entrance to the Institute.

Meanwhile, Captain Hunt's services as a skilful chemist and metallurgist were in constant demand in the courts, in consultation, and in the perfecting of metallurgical processes, and it was in the latter capacity that he had the Hall Process for the reduction of aluminum brought to his attention. He was quick to see its merit, although a very prominent metallurgical concern had, after trial, given it up. So soon as he had convinced himself of its possibilities, he organized a company among his personal friends to purchase the control of the patents and erect the first works of The Pittsburg Reduction Company. As illustrating his marvellous energy and quickness of action, as well as the confidence of his friends in his judgment and integrity, it may be mentioned that

it was only half a day from the time that he decided to try to secure the rights to this process until he had the subscription of funds and the assignment of the patent rights secured and a plan of operation outlined. Aluminum was then selling at fifteen dollars per pound; to-day, the ingots sell at thirty cents per pound. It was then a very rare metal, occasionally used in a small way by an instrument maker for some service demanding special lightness; to-day, the concern of which Captain Hunt was president is making three million pounds per year, and was in the midst of new constructions, designed to quickly double this capacity. The metal is to-day actively disputing the place of copper and brass for large long-distance electric conductors, kitchen utensils, and hundreds of minor purposes. He was quick to see that the lower the cost, the greater might be the profit, and that if any large output was to be sold, it must be manufactured at a price to compete with copper; therefore, by persistent search for the best mineral, the cheapest power, and the best factory appliances, he brought the price down to from ten to twenty per cent. below that of brass or copper, measured bulk for bulk, or for equal electric conductivity.

While due credit must be given to the profound chemical skill of Mr. Hall, in inventing and perfecting the process, it was Captain Hunt's marvellous energy, combined with bold business judgment and scientific knowledge, that secured the commercial success and brought about the widely extended use of this metal.

Few men have so wide a circle of acquaintances and friends, and it is as a friend and for his rare personal qualities that the loss of Captain Hunt will be most deeply felt. Never too busy for a quiet joke or a hearty laugh, with no bitterness or malice toward those who had crossed his path in business, a joyous good nature was the safety-valve that relieved the high pressure at which he worked. If sometimes his enthusiasm made him appear for the moment visionary, if once in awhile he was forced to cover a broad subject too quickly to study it deeply, there was a sincerity and openness in the statement of his views which saved misleading. For his straightforward integrity, open as the day, free-hearted generosity and kindness, of which pages might be filled with

anecdote by those who knew him most intimately; for a fervent loyalty to his country, his Alma Mater, his family, and to his friends; for a merry and hearty spirit which lightened the work of all around him, all those who knew him loved him, and now mourn his loss. J. R. F.

1891

GEORGE HENRY KIMBALL OXFORD, Course VI., died at his home in Cambridge, Mass., May 2, 1899. He was born in Cambridge, October 26, 1869, and lived there until graduation. He prepared for the Institute in the Cambridge High School, and entered the college with the class of '91. Exceptionally bright, he always stood high in his class, and was graduated with honor. Before graduation he accepted a position with the American Telephone and Telegraph Company in New York, as associate electrician, entering on his duties in June, 1891. Besides having fine expert knowledge, he was endowed with an unusual amount of common sense, and immediately became an invaluable aid to his chief, Mr. Pickernell. In April, 1893, he was stricken with a combination of diseases, of which pleurisy was the chief. He was dangerously ill for many weeks, but his fine constitution brought him through; yet it was many months before his strength returned and allowed him to resume his duties, — his position being held for him. In June of the succeeding year he was called to the Chicago office, to take the position of district inspector, and was of great service to the company there, but on account of his health, not having entirely recovered from his severe illness, he was transferred to the Bell Telephone Company of Colorado. This change did not give him the relief expected, and he returned to his home in Cambridge. After a rest of a few months, he accepted a position in the Boston office. His iron will and never-give-in spirit kept him at his desk until a few weeks before the end. At Tech he was keenly interested in athletics, being pitcher in the class game. He was one of the strongest and healthiest men in the college. There was no man

in the class whose future promised greater success, but in God's good providence he was called to labor above. He leaves a host of sorrowing friends here among his home friends and everywhere where he was known. As one associated with him at Tech and in New York has said, "a finer fellow never lived." He was greatly respected in his business connections and was one in whom the company had every confidence. W. I. P.

1895

HERBERT W. CHAMBERLAIN, a graduate of the Massachusetts Institute of Technology, died on the 26th of May, 1899, at Siena, in Italy, where he was pursuing a course of advanced architectural study under the direction of the Institute.

He was born in Hudson, Ohio, in 1867, and took the degree of B. Sc. in 1889 in the Iowa State Agricultural College, of which his father was at that time president.

Immediately on graduation he went into the office of Burnham & Root, architects, Chicago, as underdraughtsman, but rapidly rose to be a foreman of draughtsmen, and a trusted superintendent of construction and adjuster of final accounts of contractors on important buildings. It was at this time that Burnham & Root were superintending the buildings of the Columbian Exposition. At the completion of the Exposition buildings he left Chicago, and entered the Course in Architecture, at the Massachusetts Institute of Technology, at the beginning of the junior year of the class which graduated in 1895.

During his course he received many honors, and in 1896 he won the annual prize of the Boston Society of Architects, a set of Letarouilly's "Edifices de Rome Moderne," for specially meritorious work during the course.

He was one of the charter members of the M. I. T. chapter of Delta Tau Delta of which fraternity he had been a member, and always showed a cordial interest in its welfare.

At the graduation exercises of his class he represented his course, reading for his thesis, "A Reception House for the Governor of

Massachusetts." This was a particularly interesting problem, as it was supposed to be placed on the land west of the State House bounded by Beacon and Joy Streets, and we all remember how President Walker called Governor Wolcott's attention to this thesis.

In the fall of 1895 he received the Savage fellowship and returned to the Institute to take a post-graduate course for the Master's degree.

Besides his other work, he submitted a design for "A Club House for Undergraduates," in one of the regular competitions of the Society of Beaux Arts Architects in New York, for which he received first mention. Many of his drawings were published in the catalogue of the M. I. T. Architectural Society. He was on the Executive Committee of this society in 1896.

After leaving the Institute he entered the office of Cabot, Everett & Mead, and it was his pencil, under Mr. Everett's direction, which made the working drawings for the restored cupola on the dome of the State House.

During the summer of 1898 he was in the office of Shepley, Rutan & Coolidge.

In September of that year he married Miss Marion L. Lewis, a graduate of the Course in Architecture in the class of 1896. They sailed at once for Italy, where he spent the winter studying under the direction of the Department of Architecture, from which he held an honorary foreign fellowship.

His chief places of study were Pompeii and the south of Italy as far as Amalfi and Paestum. Then he spent two months at the American School in Rome, which occupies the Casino dell' Aurora, formerly a part of the Villa Ludovisi. During this time he made carefully measured drawings, plans, and elevations of the hospital of San Spirito, near St. Peter's. These drawings are at present in the Institute's possession, and are of decided architectural value.

After leaving Rome he sketched and studied in the Campagna, in Tivoli, and as far into the hill towns as Montepulciano and Pienza.

In Siena, on May 10th, he was apparently in his usual perfect health, and had sketched all day, when he was suddenly taken with acute peritonitis, and after a terrible illness of sixteen days he died.

A part of the drawings which he had prepared during his Italian trip was exhibited last winter in Boston and attracted favorable comment. Particularly novel and interesting to students are the daintily rendered small scale plans and elevations of small Italian buildings.

While at the Institute of Technology, Mr. Chamberlain won the admiration of his comrades by his close application to his school work, by his keen appreciation and interpretation of every problem, and by his readiness to assist his fellow students.

The memory of his untiring devotion to his chosen profession, as well as the valuable drawings which he left, will be a constant stimulus to those of us who knew him.

FRANK A. BOURNE, '95.

1899

GUY PRENTISS BURCH. — The sudden death of Guy Prentiss Burch, on the morning of April 11th, of cerebro-spinal meningitis, was deeply felt at the Institute and cast a gloom over much of the remainder of the year. Burch was a member of the Senior Class and was one of the best known men in the Institute. During their undergraduate career few men worked harder or more unselfishly for their college than Guy Burch did for Technology, and no man deserved better the success which he achieved in the many lines of undergraduate activity in which he was prominent. Quiet and unassuming, he made friends slowly, but his friendships were lasting. His high ideals, his sincerity, his uprightness, and above all his manliness won the respect and admiration of all.

Guy Prentiss Burch was born January 13, 1877, in Dubuque, Iowa. In the fall of 1895 he entered the Institute with the class of '99, taking the course in civil engineering. As a student his record was one of exceptional merit, and he always ranked high in his studies. In his freshman year he played left field on the class baseball team. This was followed the next year by his beginning work on the track. Trouble with his heart, however, compelled him to give up training, but not until he had secured

recognition as one of the most promising athletes in the Institute. In this year he served on the electoral committee for *Technique*, *'99*. During junior year he again took up track work, closing a season full of noteworthy performances by winning the 220-yard low hurdles at the Worcester meet, lowering the N. E. I. A. A. record to 25.3-5 seconds. The Institute record for individual excellence in athletics for the season of 1897–98 is held by Guy Burch with a score of 40 points.

On the return trip from Worcester he was unanimously elected captain of the 'Varsity track team for the present year. When the Advisory Council on Athletics was organized, Burch was elected representative for the Institute Committee, a position which he held up to the time of his death. In May of 1898 he was elected to the Board of Editors of *The Tech*. Soon after, he became the Technology correspondent of the *College Athlete*, and when the TECHNOLOGY REVIEW was established assumed charge of the department of undergraduate athletics. He was a prominent member of the Hare and Hounds Club, the Tennis Association, the Gun Club, the Civil Engineering Society, and the Technology Club.

Early in his senior year the pressure of his many duties caused him to resign the captaincy of the 'Varsity track team. In December he suffered a severe attack of appendicitis. Recovering, he at once resumed his work with characteristic energy. Early in the second term he was elected to the Class-day nominating committee and later to the Class-day committee, receiving the highest number of votes cast for any one man. Later he was appointed chairman of the Senior Portfolio. He was busily engaged in the work of these various committees at the time of his death.

Resolutions from the Board of Editors of *The Tech*, the Class of '99, the M. I. T. Athletic Association, the Civil Engineering Society, the Portfolio Committee, the Course in Civil Engineering, and the Advisory Council on Athletics expressive of a sense of deep loss and sorrow at the death of Guy Prentiss Burch were printed in *The Tech*.

M. B.

REVIEWS

DISCUSSIONS IN EDUCATION

By Francis A. Walker, Ph. D., LL. D., late President Massachusetts Institute Technology. Edited by James Phinney Munroe. 8vo. Pp. v.–342. New York, Henry Holt & Co., 1899.

The appearance of this volume of addresses and papers is an occasion not only of importance in educational literature, but must be one of deep satisfaction to all those who had come in personal contact with General Walker, and especially to those who have followed his thought and utterances upon educational matters. To many of the latter it has long been a cause of regret that some of the strongest and most virile of his writings upon educational topics have been almost inaccessible, and their influence for this cause restricted far short of the scope to which they are entitled.

As one reads this volume, the impression of personality stands out much as in contact with the man who penned its lines. There is the same sanity and breadth of view, the same modesty and courtesy, and withal the same incisiveness and force of conviction that placed the man so high in the love and respect of all who knew him.

It is indeed because these papers were so much a part of the man, and such sincere expressions of a strong and many-sided personality that they present at once so much of power and charm. They are not so much the studies of a specialist as the expressions of a broad-based and strenuous life, a life that touched thought and experience on many sides, a life rich in its sympathies and interests, a life that knew no compromise with truth. They are the expressions, too, of a man who retired from rather than sought public speech, yet who, when a voice was needed, spoke fearlessly and convincingly, but for the rest was more content with action.

General Walker was not a prolific writer even in the field of education to which he devoted his ripest years. His convictions in this province he wrote in deeds rather than in words, and yet probably nowhere else have the higher claims of technological education been voiced as they have in the first series in this volume.

The economic place of schools of technology no one understood better than General Walker, and with this side he deals with characteristic clearness and precision. It is with another side, however, that the burden of these papers is concerned: the value of the training afforded in such schools as a means of character building. Separately and collectively these papers and addresses form a keen and resolute attack upon the academic claim that only philosophic and literary studies can yield the fruits of true culture. This idea was one which General Walker vigorously and unsparingly assailed, and to the onslaught he brought all his strength of conviction, maturity of observation, and knowledge of student life. That work in applied science tends in a high degree to arouse earnestness and zeal, and makes toward honesty and manliness of character, were deep convictions with General Walker, and that the results of such training often contrasted strongly in these respects with those of the traditional curriculum, he never hesitated to affirm.

This note is first sounded in the address upon "Immediate Problems in Technological Education," and it continues to be voiced to the last paper in the series. The contention that the study of science and applied science tends to make men as "modest, loyal, fine, and pure as the best products of the classical culture, and withal more exact, resolute, and strong," is always the principle for which he was ready to do vigorous battle.

Again, in the address upon "The Rise and Importance of Applied Science in American Education," he declares that these schools "are to-day doing a work in the intellectual development of our people which is not surpassed, if indeed it be equalled, by that of the classical colleges." And further on: "Too long have we submitted to be considered as furnishing something which is, indeed, more immediately and practically useful than a so-called

liberal education, but which is, after all, less noble and fine. . . . It is true that something of form and style may be sacrificed in the earnest, direct, and laborious endeavors of the student of science; but that all the essentials of intellect and character are one whit less fully or less happily achieved through such a course of study, let no man connected with such an institution for a moment concede."

No cause had ever a more fearless or more devoted champion. No educational reform had ever a more earnest advocate than this scholar trained (as he termed it) in the "old-fashioned" mode, but whose life and thought paid fealty to the new.

The paper upon "The Relation of Professional and Technical to General Education" is a criticism of the view that an ideal course of education should embrace three stages: first, disciplinary; second, liberalizing; third, professional or technical. Here again the author takes vigorous exception to the claim that only from classical or philosophical studies comes a truly liberalizing and uplifting tendency. He points with considerable emphasis to the ofttimes demoralizing effect wrought by "the leisure of academic halls," and raises the question whether the average man can well stand four years of college life lacking in immediate, direct incentive, without some slackening of moral fibre. In General Walker's mind an ideal scheme of education would embrace both disciplinary and liberalizing elements throughout its entire range from general to professional, the one tending to strengthen and intensify, and the other to broaden the outlook and expand the mind.

It is an index of General Walker's essential breadth and sanity that, while holding such emphatic convictions upon the virtue of this first kind of study, he should thoroughly recognize the importance of the second. His outlook upon technological education had no concern with the cheap preparation for immediate professional success. It was the laying a foundation for the highest future development and ultimate success that engaged his sympathy and interest, and for this end he believed that all students in a technological school should, "in addition to the studies and exercises which will make them resolute, exact, and strong," have "at

least a moderate measure of the studies and exercises which will make them also broad and high and fine."

Scarcely less important than General Walker's utterances upon technological education are his papers and address upon the subject of manual training. At a time when few indeed appreciated the true significance of this new agency in education, his voice was raised clearly and vigorously in its support. From the first, he struck at the heart of the movement, and free both from the intrenched prejudice of the conservative educator and from the narrow utilitarian bias of many of the advocates of the new idea, he pointed out with characteristic clearness the real meaning and importance of the subject.

Against the gross misconceptions and prejudice that prevailed, he argued with a skill and logic that betrayed a sympathetic knowledge of child nature and much appreciation of the problems of general education. Speaking thus in these early days of contention and misconception, with all the weight of his reputation and authority, General Walker performed an invaluable service to the cause of manual training in this country and made in these papers and addresses a contribution that must always remain an important element of the classical literature of the subject. His breadth of attitude toward the subject is indicated in the paper upon "Industrial Education," delivered in 1884, in which he advocates the introduction of manual training "not for the purpose of training the pupil to become an operative in any particular branch of industry which it is presumed he will enter; but as a part of the general education of the scholar, with reference to the fuller and more symmetrical development of all his faculties and powers, and to the promotion of his success in whatever sphere of labor it shall subsequently be determined he is to enter."

The great economic value of manual training in the public schools was a consideration General Walker fully recognized, and one to which he attached much weight; but this idea he counted as strictly subordinate to the purely educational, character-forming influence of the subject. To him the essential core of the new movement was a training in doing as opposed to mere learning,

a training of the powers as distinct from the acquisition of knowledge.

It is noticeable that in this first paper almost all of the specific claims for manual training which were expanded and refined in later papers are definitely stated or suggested. Among the most important of these are: The training of the perceptive and reasoning powers, the development of the executive faculty, promotion of a respect for labor and the laborer, appeal to boys not reached by other studies, and the securing of greater interest of pupils in their work and larger support of the schools on the part of parents.

One of the fruits of manual training made an especial appeal to General Walker, and that this should be so was peculiarly characteristic of the man. This was, to use his own words, "the maintenance and promotion of a sense of social decency," and the picture that he draws of the tidiness, neatness, and general well-kept character of the New England village of a generation ago, "when every house was in order and in repair, the fence entire, the gate hung, the shutters in place, the sash fully glazed," and the striking contrast, in many cases, under the changed population of the present day, is one that should be read by every American who has the welfare of his country at heart.

Another feature in manual training that especially attracted the sympathy of General Walker was the great value of sewing and cooking for girls. The great hygienic and social significance of both of these agencies appealed to him no less than their educational value, and he placed them second in importance to no other lines of work in the new education.

Among the papers and addresses collected under "College Problems," there is one that should be read by every past student of the Massachusetts Institute of Technology at this time when the plan of a Walker Memorial Gymnasium is under consideration. Perhaps never before has the place of athletics in education been so scientifically nor, again, so eloquently set forth as in this Phi Beta Kappa oration. Without in any way overlooking the dangers or glossing over the positive abuses of college athletics, the great value of intensive sport in developing "steadiness of nerve, quickness

of apprehension, coolness, resourcefulness, self-knowledge, self-reliance," is most convincingly portrayed. The most prejudiced opponents of athletics could hardly fail to be moved by the picture of the gradual change in the ideals alike of college and nation that has accompanied the development of athletics during the last generation.

But with all his convictions as to the value of athletics in college life General Walker believed that the ideas of competition and championship should stop at the doors of the professional school. Gymnastics he firmly believed are for all stages; friendly team work, for the sport of the thing, he considered might be continued, but the exactions demanded by the professional preparation for life he felt did not allow the time and strength for intercollegiate competition.

Nowhere are the qualities of General Walker's style of expression better illustrated than in this address upon college athletics. Here, as indeed in all his writing, the impression is always of simplicity yet forcefulness, of clear-cut words standing for clear-cut thoughts. There are no flights of rhetoric, but always the touch of a warm imagination lending a glow to the careful and restrained statement of the scientist. It is the eloquence of simplicity.

There are many other papers, reference to which the limits of this review render impossible. Suffice it to say that one cannot read their pages without increased admiration and respect for the breadth and balance of the mind that touched with such sureness so many of the educational problems of the day.

Thankful may we well be that these papers have been made permanently available to us, and grateful indeed to the editor whose loving and discriminating care has brought them to us in such admirable form.

C. R. Richards, '85.

THE MICROSCOPY OF DRINKING WATER

By George Chandler Whipple, S. B., Biologist and D rector, Mt. Prospect Laboratory, Department of Water Supply, Brooklyn, N. Y.; formerly Biologist of the Boston Water Works. Pp. vii.–300. 19 plates. New York, John Wiley & Sons, 1899.

This volume is of special interest to all connected with the

Massachusetts Institute of Technology for two reasons: first, because its author, a graduate of the Institute in the class of 1889, has devoted himself almost constantly for the last ten years to the subject which he has now presented to the public, and in which he is easily the first authority in the United States; second, because the subject itself has nowhere else in the world received such attention or undergone such development as in the State of Massachusetts, largely at the hands of investigators connected with the Massachusetts Institute of Technology.

When, in 1887, the State Board of Health of Massachusetts began that remarkable series of studies on the purification of water and sewage and the rational conservation of the purity of inland waters, which has added so much to our knowledge of sanitary science, it became clear to those who had the matter in charge that, in addition to the ordinary chemical analyses, it was desirable to submit water to biological examination. This again quickly differentiated itself into bacteriological and microscopical examinations, — the former dealing with the almost infinitely minute bacteria, sub-microscopic in size; the latter with the larger forms of the microscopic world, capable of examination by the aid of the microscope alone. Here, however, there was no thoroughfare, and a pathway had to be made for those who would enter into these fields. Methods were accordingly devised, largely by students and professors of the Institute, by which it became possible, roughly, to be sure, but still far better than ever before, to detect, study, and enumerate such microscopical organisms. Mr. Whipple took up the work soon after its beginning, threw himself into it with enthusiasm and devotion, and the present volume testifies to his success. It should be distinctly understood that nowhere else in the world has anything like the same progress been made in the microscopy of drinking water as in America. The methods in vogue in England and in Germany to-day even are rudimentary and crude in the extreme when compared with those laid down in this volume.

The author states in his preface that his book has a twofold purpose.

"It is intended primarily to serve as a guide to the water analyst and the water-works engineer, describing the methods of microscopical examination, assisting in the identification of the common microscopic organisms found in drinking water, and interpreting the results in the light of environmental studies. Its second purpose is to stimulate a greater interest in the study of microscopic aquatic life and general limnology from the practical and economic standpoint."

The objects thus modestly stated would alone amply justify the preparation of a book of this character and make it welcome to the chemist, the engineer, and the sanitary biologist. In fact, however, Mr. Whipple's work is much more than this. Its appearance marks an epoch in the history of water analysis. The time has long since gone by when it will suffice for the water analyst to sit in his laboratory and determine the condition of a water simply by chemical methods. The modern biological examination has already taken its place beside the chemical, and Mr. Whipple's book testifies to the progress which has been made in one aspect of the biological examination.

The first few chapters are devoted to the history of the subject, the objects and methods of microscopical examination, and a statement of the microscopic organisms found in water from different sources. Then comes a chapter on the new science of limnology, which is the study of masses of water considered as wholes, their temperature, diathermancy, seasonal variations, periods of circulation and stagnation, color, susceptibility to bleaching, light absorption, etc., — all matters of great practical importance to water-works engineers. The geographical, seasonal, and other aspects of the distribution of organisms are next considered, both theoretically and practically. The odors with which water-supplies are afflicted are thoroughly dealt with, and the first part ends with an intelligent and far-sighted discussion of water-storage and the growth of organisms in service pipes. The rest of the book — nearly one-half in quantity — is properly given to descriptions and illustrations of the various organisms likely to be met with in water-works, a matter of very great practical importance to all who deal with this

subject, especially because adequate means of identifying the forms observed are both costly and difficult to obtain. In the publication of the figures, Mr. Whipple has certainly been highly successful, and the way in which they are reproduced cannot be too much commended, the individual figures being both soft in texture, and, for the most part, good likenesses of the organisms met with in water-supplies.

The volume is a distinctly novel and important contribution to our knowledge of water-supply and a valuable tool for the water-works engineer or superintendent, and the sanitary biologist. It has already been introduced as a text-book in the course in sanitary biology at the Institute. WM. T. SEDGWICK.

PUBLICATIONS OF THE INSTITUTE

HOFMAN, HEINRICH O., E. M., Ph. D., Asst Prof., 1889–91; Assoc. Prof., 1891–98; Prof., 1898.

1894. (With C. D. Demond.) Some Experiments for Determining the Refractoriness of Fire Clays. *Trans. Am. Inst. Min. Eng.*, XXIV., 42.

1895. The Equipment of Mining and Metallurgical Laboratories. *Id.*, XXV., 301.

1895. Further Experiments for Determining the Fusibility of Fire Clay. *Id.*, XXV., 3.

1897. German and American Technical Schools. *Eng. and Min. Jour.*, March 6, April 3, May 1.

HOLLIS, FREDERICK S., S. B., V. (M. I. T.), 1890; Ph. D. (J. H. U.), 1896.

1896. A Further Investigation of the Chlorides of Paranitro-orthosulphobenzoic Acid. Inaugural Dissertation, Johns Hopkins Univ.

1898. Microscopical and Bacteriological Examination of the Sources of Water Supply of Reading, Pa., and of Applied Water and Effluents from Experimental Filters. Appendix A, Report on Filtration, Board of Water Commissioners, Reading, Pa.

HOLLIS, WALTER M., S. B., VI. (M. I. T.), 1896.

1897. Suggestions for Electric Railway Practice. Car Operation. *Am. Electrician.* August.

1897. Maintenance. *Id.* November.

HOLMAN, SILAS WHITCOMB, S. B., VIII. (M. I. T.), 1876. Asst., 1876–1880; Instr., 1880–1882; Asst. Prof., 1882–1885; Assoc. Prof., 1885–1893; Prof., 1893–1897; Prof. Emeritus, 1897–

1895. Galvanometer Design: Waste Space Near the Needle. *Phil. Mag.*, XL., 494–497.

1895. Thermo-Electric Interpolation Formulæ. *Proc. Am. Acad. A. and S.*, XXXI., 193–217 (1895); *Tech. Quar.*, VIII., 353–377; *Phil. Mag.*, XLI., 465–488.

1895. (With R. R. Lawrence and L. Barr.) Melting Points of Aluminum, Silver, Gold, Copper, and Platinum. *Proc. Am. Acad. A. and S.*, XXXI., 218–233 (1895); *Tech. Quar.*, IX., 24–39; *Phil. Mag.*, XLII., 37–51.

1895. Pyrometry: Calibration of the Le Chatelier Thermo-Electric Pyrometer. *Proc. Am. Acad. A. and S.*, XXXI., 234–244; *Tech. Quar.*, VIII., 294–304.

1895. Calorimetry: Methods of Cooling Correction. *Proc. Am. Acad. A. and S.*, XXXI., 193–217; *Tech. Quar.*, VIII., 344–352.

1896. Computation Rules and Logarithms, with Tables of Other Useful Functions. 8vo, pp. xlv., 73. Macmillan & Co., N. Y. and London.

1898. Matter, Energy, Force, and Work. 8vo. pp. 260. Macmillan & Co., N. Y.

HOMER, E. B., S. B., IV. (M. I. T.), 1885. Instr., 1887–90; Asst. Prof., 1890–95; Assoc. Prof., 1895–

1897. An Architectural Summer School Abroad. Seven articles, beginning July 1, in *American Architect.*

1897. Same subject. *Tech. Quar.*

HOPKINS, ARTHUR T., S. B., XI. (M. I. T.), 1897.

1898. (With Ellen H. Richards.) The Normal Chlorine of the Water Supplies of Jamaica. *Tech. Quar.*, XI., No. 4.

HORTON, THEODORE, S. B., XI. (M. I. T.), 1894.

1894. An Account of the Late Epidemic of Typhoid Fever in Montclair, N. J. *Medical Record*, Nov. 24.

1897. A Form of Mass Diagram for Studying Yield of Watersheds. *Engineering Record*, July 31.

HOUGH, THEODORE, A. B., Ph. D. (J. H. U.). Instr., 1893–95; Asst. Prof., 1895–

1895. On the Escape of the Heart from Vagus Inhibition. London *Jour. of Phys.*, XVIII.

1896. (With M. O. Leighton.) The Duration of Cardiac Standstill with Different Strengths of Vagus Inhibition. *Jour. of the Boston Soc. of Med. Science*, I.

HOWE, HENRY M., A. M. (Harv.), S. B., III. (M. I. T.), 1871. Lecturer, 1884–1897.

1893. Manganese Steel. *Jour. of Franklin Inst.*, February and March; *Am. Engineer and R. R. Jour.*, LXVII., 234.

1893. The Heat Treatment of Steel. *Trans. Am. Inst. Min. Eng.*, XXIII., 466.

1894. Manganese Steel for Mining Purposes. *Eng. and Min. Jour.*, LVII., 385.

1894. Manganese Steel for Safes. *Am. Machinist*, 7.

1894. Brussels Meeting of the Iron and Steel Institute. *Eng. and Min. Jour.*, LVIII., 245 and 292.

1894. Recent Advances in Pyrometry. *Trans. Am. Inst. Min. Eng.*, XXIV., 798.

1894. Discussion on "Does the Vibration of Stamp-Stems Change Their Molecular Structure?" *Id.*, XXIV., 839.

1894. The Crystallization of Iron. *Eng. and Min. Jour.*, LVIII., 484.

1894. Our Possibilities. *Id.*, XXIV., 742.

1894. Pyrometry and the Heat Treatment of Steel. *Id.*, XXIV., 746.

1894. Discussion on Aluminum-Bronze. *Trans. Am. Inst. Min. Eng.*, XXIV., 878.

1894. Discussion on the Use of Caustic Lime in the Blast-Furnace. *Jour. Iron and Steel Inst.*, 1894, 87.

1895. Inferences from Andrews's Late Researches on the Corrosion of Iron. *Eng. and Min. Jour.*, LIX., 99.

1895. A Possible Explanation of Kernel Roasting. *Id.*, 164.

1895. A Possible Explanation of Kernel Roasting. *Eng. and Min. Jour.*, LIX., 267 and 364.

1895. Ledebur on the Proximate Constitution of Steel. *Id.*, 437.

1895. The Relation between Temperature and the Grain of Steel. (By A. Sauveur and H. M. Howe.) *Id.*, LX., 537.

1895. The Hardening of Steel. *Jour. Iron and Steel Inst.*, 1895, 258.

1895. Abstract of Above. *Eng. and Min. Jour.*, LX., 173.

1896. The Bessemer Process. *Id.*, LXI., 227.

1896. On the Casting of Steel. *Id.*, 395.

1896. (With A. Sauveur.) Further Notes on the Hardening of Steel. *Jour. of Iron and Steel Inst.*, 1896, I., 170; *Engineering*, 1896, 757.

1896. Evidence for the Allotropic Theory. *Eng. and Min. Jour.*, LXII., 557.

1897. Reply of Henry M. Howe to the Discussion of his Paper on the Hardening of Steel. *Jour. Iron and Steel Inst.*, 1897, I., 193.

1897. Evidence for the Allotropic Theory. *Eng. and Min. Jour.*, LXIII., 111.

1897. The Tenacity of Steel Wire. (A correction.) *Eng. and Min. Jour.*, LXIV., 3.

1897. The Hardening of Steel. *Trans. Am. Inst. Min. Eng.*, February.

1897. The Connection between the Hardening Power and the Retardations of Low Carbon Steel. *Eng. and Min. Jour.*, XLIV., 367; *Engineering*, 1897, 514.

1897. The Hardening Power of Low Carbon Steel. *Id.*, 748.

1898. Report on Relative Merits of Wrought-iron and Steel Pipes to the National Tube Works Co.

1898. The Relative Strength of Wrought-iron and Steel Pipes. (Abstract of above.) *Eng. and Min. Jour.*, LXV., 400.

1898. Discussion of Lieut. Ackerman's paper on "Face Hardened Armor." *Proceedings of United States Naval Institute*, XXI.

HANCHETT, GEORGE T., S. B. (M. I. T.), 1893.

1895. Microscopical Research on the Electrostatic Discharge. *Elec. World*, 389 and 607.

1895. A Suggestion for a Dynamometer. *Id.*, 542.

1897. Alternate Current Wiring. *Am. Electrician*, 58.

1897. Calculation of Wires for Magnets. *Elec. World*, 499.

1897. A Suggestion for the Construction of Induction Coils. *Id.*, 499.

HUNNEWELL, FREDERICK A., S. B., XIII. (M. I. T.), 1897.

1897. Four Place Table of Logarithms. Cambridge, Mass.

HUNT, SAMUEL P., S. B., A. M., X. (M. I. T.), 1895.

1895. (With A. H. Gill.) The Determination of Methane and Hydrogen by Explosion. *J. Am. Chem. Soc.*, XVII., 986–994.

HUSSEY, OREN S., S. B., II. (M. I. T.), 1887.

1891. Electricity in Mill Work. Pph. N. E. Cotton Manfrs. Asso.

HUTCHINSON, W. SPENCER, S. B., III. (M. I. T.), 1892.

1896. The Gates Canvas Plant. *Mining and Scientific Press.* San Francisco, Cal., October 3.

INGALLS, WALTER R., S. B., III. (M. I. T.), 1886.

1893. Chronology of Gold and Silver Mining. *Min. Ind.*, I.

1893. Cadmium. *Ibid.*, II.

1893. The Zinc Industry in Europe. *Ibid.*

1893. Production and Distribution of Lead. *Ibid.*

1893. The Rare Elements. *Ibid.*

1894. The American Practice in Lead Smelting. *Eng. Mag.*, VI.

1895. Tin Deposits of Durango, Mexico. *Trans. Am. Inst. Min. Eng.*, XXV.

1895. The Nomenclature of Zinc Ores. *Ibid.*

1896. Precipitation of Gold from Cyanide Solutions. *Min. Ind.*, IV.

1897. The Tin Deposits of Mexico. *Trans. Am. Inst. Min. Eng.*, XXVII.

1897. Borax and Boracic Acid. *Min. Ind.*, V.

1897. Lead, Review of the Industry in 1896. *Ibid.*

1897. Zinc, Progress in Mining and Metallurgy. *Ibid.*

JACKSON, DANIEL D., S. B., V. (M. I. T.), 1893.

1896. On an Improvement in the Sedgwick-Rafter Method for the Microscopical Examination of Drinking Water. *Tech. Quar.*, IX., 271.

1897. (With J. W. Ellms.) On Odors and Tastes of Surface Waters with special reference to Anabaena, a Microscopical Organism found in certain Water Supplies of Massachusetts. *Id.*, X., 410.

JENKINS, CHARLES D., S. B., V. (M. I. T.), 1882.

1894–97. Report of Inspector of Gas and Gas Meters. (Yearly Reports to Massachusetts Legislature published as Public Documents.)

JORDAN, EDWIN O., S. B., VII. (M. I. T.), 1888, Ph. D.

1894. (With A. C. Eycleshymer.) On the Cleavage of Amphibian Ova. *Jour. of Morphology*, IX., 407.

1894. The Identification of the Typhoid Fever Bacillus. *Jour. of Am. Med. Assoc.*, December 22.

1895. On Some Conditions Affecting the Behaviour of the Typhoid Bacillus in Water. *Medical News*, September 28.

1896. The Filtration of Public Water Supplies. *University Record*, November 13.

1897. The Biological Problem of To-day. *The Dial*, May 16.

1897. Shaw on Municipal Government in Continental Europe. *Science*, 450.

1897. Migula's System der Bakterien. *Bot. Gaz.*, 379.

1897. Fischer's Vorlesungen uber Bakterien. *Ibid.*, 439.

1897. Sanarelli's Work upon Yellow Fever. *Science*, 981.

1898. Meyer on Bacterial Structure. *Bot. Gaz.*, 213.

KENDALL, CHARLES B., S. B., V. (M. I. T.), 1887. Asst., 1887–88.

1895. Substantive Colors. *Dyers Trade Journal*, Philadelphia.
1895. Sulphamine P. *Ibid.*

KILHAM, WALTER H., S. B., IV. (M. I. T.), 1889.
1897. Mediterranean Gardens. *Am. Architect*, LVI. Nos. 1,111, 1,114 and 1,116.

KIRKHAM, GUY, 1887.
1894. "The Best Security." Springfield, Mass., Booklet.

LANZA, GAETANO, S. B., C. E., Instr., 1871–72; Asst. Prof., 1872–75; Prof., 1875–
1893. The Educational Process of Training an Engineer. *Proc. Internat. Congress of Education*, Chicago, 1893. Also *Tech. Quar.*, VI.
1893. Graduating Theses. *Proc. Soc. for Promotion of Eng. Education.*
1893. Discussion on Strains in Fly-band Wheels. *Proc. Am. Soc. Mech. Engrs.*
1893. Notes on the Action of the Reciprocating Parts of a Steam Engine. New Edition. Pph. 8vo. Boston.
1894. The Organization and Conduct of Engineering Laboratories. *Proc. Soc. for Promotion of Eng. Education.*
1894. Discussion on the Theory of Shaft Governors. *Proc. Am. Soc. Mech. Engrs.*
1894–95. Engineering Practice and Education. A course of six lectures prepared for delivery in the Lowell Institute in Boston, three of which were not delivered on account of the sickness of the author. *Jour. of the Franklin Inst.* May, 1894–February, 1895.
1895. Application of Brakes to the Truck Wheels of a Locomotive. *Proc. Am. Soc. Mech. Engrs.*
1895. Stresses in the Rims and Rim-joints of Fly-wheels. *Ibid.*
1895. (With E. F. Miller.) Some Tests of the Strength of Spruce Columns. *Ibid.*
1895. Discussion on The Civil Engineer of the Twentieth Century. *Proc. Soc. for Promotion of Eng. Education.*
1895. Discussion on Graduation Theses and Degrees. *Ibid.*

1896. Applied Mechanics. 8vo, pp. 929. New York. (Second revised edition.)

1896. Notes on Dynamometers, Planimeters, Governors, and Fly-wheels. 8vo. (Second revised edition.) Boston.

1896. Notes on Friction. 8vo, pp. 139. (Second revised edition.) Boston.

1897. Strength of columns. Abstract of a paper presented to the British Association for the Advancement of Science at Toronto meeting. *Proc. Brit. Assn. Adv. of Science.*

LAUDER, GEORGE B., S. B., VI. (M. I. T.), 1889.

1897. How to Become an Electrical Engineer. *Electrical Review of N. Y.*, December 8.

LAWS, FRANK A., S. B., VI. (M. I. T.), 1889. Asst., 1889–91; Instr., 1891–92; Asst. Prof., 1897–

1893. Preliminary Note on a Method for the Harmonic Analysis of Alternating Currents. *Tech. Quar.*, VI., 252.

1894. On an Apparatus for the Measurement of Coefficients of Self-induction, and the Investigation of the Phenomena of Alternating Currents. *Proc. Am. Acad. Arts and Sci.*, XXIX., 261.

1894. (With Henry E. Warren.) Experiments on the Relation of Hysteresis to Temperature. *Id.*, XXX., 490.

1896. Notes on the Best Form of Cross Section for the Coils of a Galvanometer. I., When the Needle is Indefinitely short. *Tech. Quar.*, IX., 169.

1897. Some Data on the Heating Error in Resistance Coils. *Id.*, X., 283.

1897. On a Method of Delicate Suspension. *Elec. World*, XXIX., 86.

1897. On the Best Resistance for a Sensitive Galvanometer. *Phys. Rev.*, V., 300.

LINDSAY, WM. B., S. B., V. (M. I. T.), 1881. Asst., 1881–82; also 1884–85. (With F. H. Storer.)

1894. Manual of Chemistry.

LITTLE, ARTHUR D., Student, 1881–84.

1894. Industrial Applications of Cellulose Thiocarbonates and Products Derived Therefrom. *Jour. Franklin Inst.*, August.

1894. (With Roger B. Griffin.) The Chemistry of Paper Making. 8vo, pp. 517. New York, Howard Lockwood & Co.

LOCKE, CHARLES E., S. B., III. (M. I. T.), 1896. (With R. H. Richards.) The Spitzkasten and Settling Tank. *Trans. Am. Inst. Min. Eng.*, XXVII.

LOCKE, WM. W., S. B., XI. (M. I. T.), 1862.

1895. Newtown Creek Nuisances. *In Health Dept. Rept.* New York.

1896. (With Joseph B. Taylor.) Refuse Disposal of Cities. *In Health Dept. Rept.*

LYLE, DAVID A., Major Ord. Dept., U. S. A., S. B., III. (M. I. T.), 1884.

1893. Report on Manufacture of Steel Forgings at the Midvale Steel Works, Philadelphia, Pa. *Report of Chief of Ordnance, U. S. A.*, Appendix 32, 411.

1893. Manufacture of Steel Forgings at the Benj. Atha & Illingworth Company's Works, Newark, N. J. *Id.* 427.

1894. Progress Report on the Manufacture of Steel Forgings, Castings, etc., at the Midvale Steel Works, Philadelphia, Pa. *Id.* Appendix 24, 251.

1895. Progress Report on the Manufacture of Steel Forgings and Castings, etc., at the Midvale Steel Works, Philadelphia, Pa. *Id.* Appendix 20, 199.

1896. Report on the Manufacture of Steel Forgings at the Midvale Steel Works, Philadelphia, Pa. *Id.* Appendix 19, 201.

1897. Progress Report on Manufacture of Steel Forgings, etc., at Midvale Steel Works, Philadelphia, Pa. *Id.* Appendix 26, 257.

MAIN, CHARLES T., S. B., II. (M. I. T.), 1876. Asst., 1877–79.

1897. The Valuation of Textile Manufacturing Property. *Am. Soc. Mech. Eng.*

MALTBY, MARGARET E., A. M., S. B., VIII. (M. I. T.), 1891. Ph. D. (Göttingen).

1895. Methode zur Bestimmung grosser elektrolytischen Widerstände. *Zeit. physik Chem.*, XVIII., 133.

1897. Methode zur Bestimmung der Periode elektrischer Schwingungen. *Ann. Phys. u Chem.*, LXI., 553.

MANSFIELD, Albert K. (Student 1869–72).

1894. The "Buckeye" Valve-gear. *Am. Soc. Mech. Eng.*, XV., 177–203.

1894. Notes on Theory of Shaft Governors. *Id.* 929–960.

MATHEWS, ALBERT P., S. B., VII. (M. I. T.), 1892. Asst., 1892–93.

1893. On Wurtz's Method for the Differentiation of the Bacillus Typhi Abdominalis from the Bacillus Coli Communis, and its Application to the Examination of Contaminated Drinking Water. *Tech. Quar.*, VI.

1895. (With Prof. E. B. Wilson.) Maturation, Fertilization and Polarity in the Echinoderm Egg. *Jour. of Morphology*, X.

1897. Internal Secretions Considered in Relation to Variation and Development. *Id.*, V.

1897. Zur Chemie der Spermatozoen. *Zeit. Physiol. Chem.*, XXIII.

1897. The Origin of Uric Acid in the Organism. *N. Y. Med. Jour.*

1898. The Physiology of Secretion. *Ann. Acad. Sci.*

1898. A Contribution to the Chemistry of Cytological Staining. *Am. J. Physiol.*, I.

1898. (With Dr. C. A. Herter.) Histological Changes in the Kidney Induced by Certain Diuretics. *Ibid.*

MATTHES, GERARD H., S. B., I. (M. I. T.), 1895.

1898. Report on the Water Powers and Pollution of the North Branch of the Potomac and of the Shenandoah River. *Senate Doc.*, No. 90, 55th Congress, 2d session.

MCKIM, ALEX. RICE, S. B., A. M., I. (M. I. T.), 1885.

1895. Improved Steel Cage Building Construction. *Eng. Record.*

1895. Hydraulic Caisson Foundations. *Ibid.*

1895. Building Disaster. *Ibid.*

1896. High Buildings. *Architecture and Building.*

1896. Fogg Museum. *Ibid.*

MILLER, EDWARD F., S. B., II. (M. I. T), 1886, Asst., 1886–88; Instr., 1888–92; Asst. Prof., 1892–

1893. (With W. A. Johnston.) Efficiency of Jack Screws. *Tech. Quar.*, VI., 352–370.

1894. A Dynamic Steam Engine Indicator Tester. *Soc. Nav. Arch. and Marine Eng.*, II., 149–159.

1895. (With G. Lanza.) Tests of Spruce Columns. *Am. Soc. Mech. Eng.*, XVI., 59–69.

1895. (With C. H. Peabody, 2d paper.) Tests on Triple Expansion Engine at M. I. T. *Am. Soc. Mech. Eng.*, XVI., 82–91.

1895. A New Cement Testing Machine. *Brick Builder*, December.

1897. (With C. H. Peabody.) Steam Boilers. 8vo., pp. 380. New York, John Wiley & Sons.

MINOT, CHARLES S., S. B., V. (M. I. T.), 1872, S. D. (Harv.), 1878; Lecturer, 1885–86.

1894. Gegen das Gonotom. *Anat. Anzeiger*, IX., 210–213.

1894. Lehrbuch d. Entwickelungsgeschichte der Menschen. Leipzig.

1895. The Psychical Comedy. *No. Am. Rev.*, CLX., 217–230.

1895. The Fundamental Difference between Plants and Animals. *Science* (N. S.), XII., 311–312.

1895. The Work of the Naturalist in the World. *Pop. Sci. Month.*, XLVII., 60–72.

1895. Uber die Vererbung und Verjüngung. *Biolog. Bbl.*, XV., 571–587.

1896. The Microscopical Study of Living Matter. *No. Am. Rev.*, CLXII., 612–620.

1896. Microtome automatique nouveau. *Compt. rend. Soc. Biologie de Paris*, 10mo., Ser. III., 611–612.

1896. Bibliography, A Study of Resources. Biol. Lectures delivered at Marine Biol. Lab., 1895, 149–168.

1896. The Theory of Panplasm (abstract). *Rep. Brit. Assn. Adv. Sci.*, LXVI. Liverpool, 832–833.

1896. The Olfactory Lobes. *Ibid.*, 836.

1896. On the Principles of Microtome Construction. *Ibid.*, 979–980.

1897. Our Unsymmetrical Organization. *The Harv. Grad. Mag.*, V., 485–491.

1897. On Two Forms of Automatic Microtomes. *Science* (N. S.), V., 857–866.

1897. Cephalic Homologies. A Contribution to the Determination of the Ancestry of Vertebrates. *Am. Naturalist*, XXXI., 927–943.

1897. Die fruhen Stadien und die Hestogenese des Nervensystems. *Ergebnisse der Anat. u. Entwickgesch.*, VI., 687–738.

MOORE, F. J., B. A., (Amherst), Ph. D. (Heidelberg, 1893). Asst., 1894; Instr., 1895–

1893. Ueber eine Methode zur Isolierung Aromatischer Sulfosaüren, (Inaugural Dissertation).

MULLIKEN, SAMUEL P., S. B., V. (M. I. T.), 1887, Ph. D. (Leipzig).

1896. (With A. A. Noyes.) Laboratory Experiments on the Class Reactions of Organic Substances. First Edit., Boston, 17 pp.

1898. The same, Second Revised Edit. Chem. Pub. Co., Easton, Pa.

1899. (With H. Scudder.) A Simple Color Reaction for Methyl Alcohol. *Am. Chem. J.*, XXI., 266–71.

1899. (With E. R. Barker.) Reactions for the Detection of the Nitro-Group. *Ibid.*, 271–76.

MUNROE, JAMES P., S. B., III. (M. I. T.), 1882

1895. The Educational Ideal; an Outline of Its Growth in Modern Times. 8vo., pp. 262. Boston and London.

1897. Francis Amasa Walker. *Book Buyer*, XIV., 48.

1898. Technical Education in the United States. *The Record of Technical and Secondary Education* (London), VII., 20.

1898. Genealogy of the Descendants of William Munro, of Lexington, Mass. In *History of the Munros*, by Alexander Mackenzie. 8vo., pp. 559–615. Inverness.

NEWELL, FREDERICK H., S. B., III. (M. I. T.), 1885.

1886. Niagara Cephalopods from Northern Indiana. *Proc. Boston Soc. Nat. Hist.*, XXIII., 466–486.

1893. Descendants of Walter Haynes and Peter Noyes, of Sudbury, Mass. *N. E. Hist. and Gen. Reg.*, January.

1893. The Arid Regions of the United States. Address delivered before the International Geographic Conference, July 27, 1893. *Nat'l Geog. Mag.*, V., 167–172.

1894. Report on Agriculture by Irrigation in the Western Part of the United States at the Eleventh Census, 1890, with Appendix and Index. Quarto, 336.

1894. Results of Stream Measurements. *Fourteenth Ann. Rept. U. S. Geol. Survey.* Part II.

1894. Irrigation. An address before the Seventh Convention of the Trans-Miss. Commercial Congress. *Official Proc. Seventh Convention of Trans-Mississippi Commercial Congress.* November.

1895. Irrigation by means of Storm Water. *Kansas Farmer.* Nov., 740.

1895. Public Lands and Their Water Supply. *Sixteenth Ann. Rept. U. S. Geol. Survey.* Part II.

1895. Preliminary Report of Board of Irrigation. *Sen. Doc.*, No. 36, 54th Cong., second Session.

1895. Report of Progress of the Division of Hydrography for 1893 and 1894. *Bulletin No. 131, U. S. Geol. Survey.*

1895. Methods and Results of Stream Measurements by the U. S. Geological Survey. *Proc. Engineers' Club, Phila.*, XII., July.

1896. Hydrographic Surveys. *Circular No. 5, Div. Hydrography, U. S. Geol. Survey.*

1896. Irrigation of the Great Plains. *Yearbook, U. S. Dept. Agri.*, 1896, 167–196.

1896. Irrigation on Indian Reservation. *Rept. Bd. Indian Commrs.*, 1896, 116–118.

1896. Report of Progress of Division of Hydrography for 1895. *Bulletin No. 140, U. S. Geol. Survey.*

1897. Hydrography of the United States. *J. School Geog.*, 129–133.

1897. Investigations of Water Supply. *Trans. Am. Inst. Min. Eng.*, July.

1897. Water Supply and Irrigation Papers of U. S. Geological Survey.

NICHOLS, HENRY W., S. B., XII. (M. I. T.), 1893.

1895. How Gold Occurs in Nature. *Chicago Mining Rev.*, January.

1895. The Metallurgy of Iron. *Id.*

1896. A Piece of Iron over 2,000 Years Old. Note. *Id.*, July.

1896. The Extraction of Zinc from its Ore. *Id.* XXXV., 4.

1897. On the Genesis of Clay Stones. *Am. Geol.*, XIX.

NOA, FREDERICK M., S. B., IX. (M. I. T.), 1894.

1898. The Pearl of the Antilles; a View of the Past and a Glance at the Future. pp. 84. New York.

NORRIS, JAMES F., A. B. (Johns Hopkins, '92), Ph. D. (Johns Hopkins, '95); Asst., 1895–96; Instr., 1896–

1895. (With I. Remsen.) Action of the Halogens on the Methylamines. *Am. Chem. J.*

1895. Some Double Salts of Selenium (Thesis).

1897. (With H. Fay.) Iodometric Estimation of Selenous and Selenic Acids. *Am. Chem. J.*

1897. Action of the Halogens on the Aliphatic Amines. *Id.*

1898. (With H. Fay.) Iodometric Estimation of Tellurium. *Ibid.*

NOYES, ARTHUR A., S. B., V. (M. I. T.), 1886, S. M. (M. I. T.), Ph. D. (Leipzig); Asst., 1887–88; Instr., 1890–94; Asst. Prof., 1894–97; Asso. Prof., 1897–

1894. (With A. A. Clement.) Löslichkeit des sauren Kaliumtartrats bei Gegenwart anderer Salze. *Zeit. physik Chem.*, XIII., 412.

1894. Die Wasserstoffionabspaltung bei dem sauren Kaliumtartrat. *Ibid.*, 417.

1894. (With W. R. Whitney.) Kryoskopische Untersuchungen mit Aluminaten und Boraten von Alkalimetallen. *Id.* XV., 694.

1894. (With A. A. Clement.) The Electrolytic Reduction of Paranitrobenzoic Acid in Sulphuric Acid Solution. *Am. Chem. J.*, XVI., 511.

1895. (With C. G. Abbot.) Eine Prüfung der Prinzipe der Löslichkeitsbeeinflussung und ein Vergleich der daraus und aus der elektrischen Leitfähigkeit berechneten Dissociationswerte. *Zeit. physik Chem.*, XVI., 125; *Tech Quar.*, VIII., 47.

1895. (With C. G. Abbot.) Die Geschwindigkeit der Reaktion zwischen Zinnchlorür und Eisenchlorid. Eine Reaktion dritter Ordnung. *Ibid.*, 546.

1895. (With R. M. Ellis.) Synthesis of Diphenylbiphenyl and its Identification as Benzerythrene. *Am. Chem. J.* XVII.; *Tech. Quar.*, VIII., 178.

1895. (With W. J. Hall.) Die Geschwindigkeit der Hydrolyse des Salicins durch Säuren. *Zeit. Physik Chem.*, XVIII., 240; *Tech Quar.*, VII.

1895. (With W. O. Scott.) Beitrag zur Kenntniss der Gesetze der Geschwindigkeit von polymolekularen Reaktionen. *Ibid.*, 122.

1895. (With J. T. Dorrance.) The Electrolytic Reduction of Paranitro Compounds in Sulphuric Acid Solution. *Ber. d. Chem. Gesel.*, XXVIII., 2,349; *J. Am. Chem Soc.*, XVII., 855.

1895. (With W. H. Watkins.) The Occurrence of Trimethylene Glycol as a By-product in the Glycerine Manufacture. *J. Am. Chem. Soc.*, XVII; *Tech. Quar.*, VIII., 261.

1896. Die katalytische Wirkung der Wasserstoffjonen auf polymolekulare Reaktionen. *Zeit. physik Chem.*, XIX., 599.

1896. Bemerkung über das Gesetz der Geschwindigkeit der Reaktion zwischen' Eisenchlorid und Zinnchlörur. *Id.*, XXI.

1896. (With H. M. Goodwin.) Die innere Reibung des Quecksilberdampfes. *Id.*, XXI., 671; *Phys. Rev.*, IV., 207.

1896. (With C. W. Hapgood.) Sind Diphenyljodonium und Thalliumnitrat isomorph? *Id.*, XXII., 464.

1896. Instruction in Theoretical Chemistry. *Tech. Quar.*, IX., 323.

1897. (With C. W. Tucker.) Formation of Diacetylenyl (Butadiene) from Copper Acetylene. *Am. Chem. J.*, XIX., 123.

1897. Synthesis of Hexamethylene Glycol Diethyl Ether and other Ethers from Trimethylene Glycol. *Ibid.*, 766.

1897. (With R. S. Wason.) The Velocity of the Reaction between Ferrous Chloride, Potassium Chlorate and Hydrochloric Acid. *Zeit. physik Chem.*, XXII., 210; *J. Am. Chem. Soc.*, XIX., 199.

1897. (With C. G. Abbot.) Bestimmung des osmotischen Druckes mittelst Dampfdruckmessungen. *Id.*, XXIII., 56.

1897. (With W. R. Whitney.) Ueber die Auflösungsgeschwindigkeit von festen Stoffen in ihren eigenen Lösungen. *Ibid.*, 689; *J. Am. Chem. Soc.*, XIX., 930.

1897. Bemerkung über die kinetische Theorie der Lösungen. *Id.*, XXIV.

1897. Qualitative Chemical Analysis. 8vo., pp. 89, 3d Ed.

1897. (With S. P. Mulliken.) Laboratory Experiments on the Class Reaction and Identification of Organic Substances. 12mo., pp. 28, 2d Ed.

1898. (With E. S. Chapin.) The Solubility of Acids in Solutions of the Salts of Other Acids. *Zeit. physik Chem.*, XXVII., 442; *J. Am. Chem. Soc.*, XX., 752.

1898. (With L. J. Seidensticker.) Die Löslichkeit von Jod in verdünnten Kalinmjodidlösungen. *Ibid.*, 357. *J. Am. Chem. Soc.*, XXI., 217.

1898. (With G. T. Cottle.) Die Geschwindigkeit der Reaktion zwischen Silberacetate und Natriumformiat. Eine Reaktion dritter Ordnung. *Ibid.*, 579.

1899. Die Beziehumg zwischen Osmotischer Arbeit und osmotische Druck. *Id.*, XXVIII., 220.

1898. The Reliability of the Dissociation Values Determined by Electrical Conductivity Measurements. *J. Am. Chem Soc.*, XXI., 517.

1898. (With D. Schwartz.) The Solubility of Salts of Weak Acids in Stronger Acids. *Ibid.*, 742.

1898. Die Theorie der Löslichkeits Beeinflussung bei zweiionigen Electrolyten mit lauten verscheidenen Ionen. *Zeit physik Chem.*, XXVIII., 268.

OSBORNE, GEORGE A., S. B.; Prof., 1866–; Sec'y of Faculty, 1868–71.

1886. Examples in Differential Equations.

1891. Differential and Integral Calculus.

PACKARD, GEORGE A., S. B., III. (M. I. T.), 1890.

1896. The Cyanide Process in the United States. *Trans. Am. Inst. Min. Eng.*, XXIII., 709.

PATTERSON, GEORGE W., JR., S. B., VI. (M. I. T.), 1887.

1894. (With M. R. Patterson.) A Treatise on Industrial Photometry. Translated from the French of A Palaz. pp. ix., 322. New York. D. Van Nostrand Co.

1895. (With H. S. Carhart.) Electrical Measurements. pp. vii., 344. Boston, Allyn & Bacon.

PICKERING, W. H., S. B., VIII. (M. I. T.), 1879; Asst., 1880–82; Instr., 1882–87.

1888. The Pinhole Camera. *Anthony's Photog. Bull.*, February.

1888. The New Dark Room of the Harvard College Observatory. *Photographic Times*, February.

1888. Total Eclipse of the Sun 1886. *Annals, Harv. Col. Obser.*, XVIII., 85.

1888. Total Eclipse of the Moon 1888. *Ibid.*, 75.

1888. Physical Aspect of the Planet Mars. *Science*, August.

1889. The Soaring of Birds. *Id.*, January.

1889. The Soaring of Birds. *Id.*, February.

1889. The Soaring of Birds. *Id.*, March.

1889. Total Solar Eclipse 1889. *Observatory*, January.

1889. Total Solar Eclipse 1887. *Id.*, May.